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# HARD CHOICES

## A Report on the Increasing Gap Between America's Infrastructure Needs and Our Ability To Pay for Them

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Appendix 3. COLORADO

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## A CASE STUDY

PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON ECONOMIC GOALS AND INTERGOVERNMENTAL POLICY

OF THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

FEBRUARY 25, 1984

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## Preface

Infrastructure problems are widespread. They do not respect regional or state boundaries. To secure a better data base concerning national and state infrastructure conditions and to develop threshold estimates of national and state infrastructure conditions, the Joint Economic Committee of the Congress requested that the University of Colorado's Graduate School of Public Affairs direct a twenty-three state infrastructure study. Simultaneously, the JEC appointed a National Infrastructure Advisory Committee to monitor study progress, review study findings and help develop policy recommendations to the Congress.

In almost all cases, the studies were prepared by principal analysts from a university or college within the state, following a design developed by the University of Colorado. Close collaboration was required and was received from the Governor's staff and relevant state agencies.

Because of fiscal constraints each participating university or college agreed to forego normal overhead and each researcher agreed to contribute considerable time to the analysis. Both are to be commended for their commitment to a unique and important national effort for the Congress of the United States.

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# Colorado's Public Infrastructure Needs and Capital Investment Planning and Budgeting Process

## A Case Study

Prepared by

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for

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October, 1982

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Colorado Water Conservation Board: David Walker

National Conference of State Legislatures: Rick Watson

In acknowledging the assistance of all of these people, I retain sole responsibility for any errors and shortcomings of this study.

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## FOREWORD

As a relatively recent invention of military and social scientists, "infrastructure" is not included in the Oxford English Dictionary.[1] As a growing problem of modern America, however, infrastructure is now a commonly used term that evokes as much concern as meaning.[2] There is little disagreement that infrastructure is the physical foundation of communities -- for example, highways, bridges, and water and sewer facilities. Whenever infrastructure is mentioned, however, it is usually done so in reference to crumbling facilities and political neglect.[3] As infrastructure in adequate repair and with sufficient capacity to meet anticipated population growth is rare, it is almost always linked with "need." As we will see, infrastructure need is easy to perceive but difficult to define.[4]

Colorado, along with New York, was recently cited by the National Conference of State Legislatures[5] as a state ahead of others in addressing infrastructure needs and capital budgeting alternatives, but the dismaying

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[1]The Compact Edition of the Oxford English Dictionary, Oxford University Press, 1971.

[2] Richard V. Watson, "Colorado and New York Evaluate Their Infrastructure Needs and Capital Budgeting Processes," Denver, CO: National Conference of State Legislatures, May 1982 (draft).

[3]For example, Patrick Choate and Susan Walter, America in Ruins, Washington, D.C.: Council of State Planning Agencies, 1981.

[4]See also Committee on National Urban Policy, Critical Issues for National Urban Policy: A Reconnaissance and Agenda for Further Study, Washington, D.C.: National Academy Press, 1982, pp. 91-93.

[5]Richard V. Watson, op.cit.;

disrepair of its highway system is also apparent when entering or leaving the State at the Kansas border.[1] It is obvious that a state must anticipate future infrastructure requirements as well as maintain its highways, but it was not until after the Blue Ribbon Panel was formed in 1979 through an Executive Order by Governor Lamm that the people of Colorado became aware of the magnitude of the investment required to provide and maintain its infrastructure.[2] According to the Panel, the investmednt required to meet Colorado's infrastructure needs between 1981 and 2001 will be about $92 billion (in 1980 dollars).[3]

Although fraught with assumptions and uncertainty, infrastructure investment planning for a future 20 years hence is useful in that it provides a common currency for individuals representing diverse interests to help set public policy on the quality of life that a community is willing to pay for. The lasting contribution of the Blue Ribbon Panel will not be its admittedly rough estimates of capital investment needs and revenues, but rather the consensus it developed among leaders of the public and private sectors that a capital investment planning and budgeting process is essential. To further the development of this process, the Center for Public-Private Sector Cooperation is coordinating a study of infrastructure investment needs that includes case studies of Colorado and three other states.

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[1] Rocky Mountain News, August 23, 1982.

[2] Colorado: Investing in the Future, The Final Report of the Governor's Blue Ribbon Panel, 4 Volumes, July 1981. Hereafter referred to as BRP, Vol. I, etc.

[3] BRP, Vol. I, p. 12.

As a part of the Colorado case study, the data and analyses contained in the final report of the Blue Ribbon Panel were examined. It soon became evident that need provided a thematic rather than a conceptual basis for the Panel's report. A better understanding of "need" is essential if it is to provide a foundation for capital investment planning and budgeting for infrastructure. In the following paragraphs, the different ways that the Panel and State agencies defined infrastructure investment needs are discussed.

The Blue Ribbon Panel approached infrastructure investment needs inductively. That is, the Panel did not attempt to define need nor did it issue guidelines for State agencies that provided data and analyses. Each agency estimated investment need for the Panel based on its own perception of infrastructure requirements and costs. Such an approach did not prevent the Panel's staff from deducing estimates of investment need by projecting historical per capita expenditure trends upon expected future population. Estimates of investment need in various infrastructure areas were then added together for an aggregate statewide estimate of need. The Panel was aware of the methodological limitations of its analyses and was careful to point out that the purpose if its report was to initiate policy discussions and not to provide precise cost and revenue figures.[1]

Can estimates of capital investment need for public infrastructure be derived deductively? In a deductive approach, investment needs would be defined independently of the functional responsibilities of individual State

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[1] BRP, Vol. II, p. 117.

agencies. A common basis for determining investment need would be established, and estimates made by any number of agencies could then be summed rather than aggregated. Such an approach, of course, presupposes that need can be defined in an axiomatic way. There are many formidable issues that impede this approach.

These issues range from fairly straightforward methodological ones to very complex ones that involve societal values and norms. Some of these issues are outlined below.

- o capital vs. operation/maintenance expenditures -- the distinction between capital and O/M expenditures is a standard one and is usually assumed in most studies, but it is not always a simple distinction. For example, lack of adequate maintenance funds will hasten the deterioration of highways and will affect the amount and timing of capital investment required for reconstruction. Improper operation and maintenance of sewage treatment facilities will reduce level of treatment as well as design capacity. Insufficient investment in O/M can negate capital investments for innovative design, energy efficiency, and pollution abatement. Capital and O/M needs, in other words, are complementary, and they are separated for many practical reasons, not for conceptual clarity. In the case of highways, even the distinctions between maintenance, repair, and reconstruction are

blurred at best. Studies of infrastructure investment needs should perhaps devote as much attention to proper operation and maintenance as they do to construction of new facilities.

- sins of the past vs. promise of the future -- the distinction between investments that are to be made in anticipation of population growth and those that are made to bring existing facilities up to a higher level of performance for the present population, is also a common one. However, "upgrading" and expansion are often done simultaneously to improve cost-effectiveness. The distinction between improvement and expansion is often made in analyses but difficult to maintain in practice.

- defining vs. forecasting need -- for infrastructure investment analyses, need must not only be defined but also projected into an arbitrary future time span. A "definition" of need will be difficult to extricate from the demographic, economic, and analytical assumptions implicit in the forecasting methodology that is used.

- need and existing infrastructure -- the question of need is relevant to the present as well as to the future. The adequacy of the existing infrastructure is a matter of dispute, and it takes a heroic leap to project future needs when there is little agreement on how well present needs are being met.

- relationship between amount of capital investment and improvement in adequacy of service -- we have not discovered how to measure this relationship and yet are quite willing to estimate how much we will have to invest to maintain a certain but unspecifiable quality of life. Estimates of investment needs are often based on an assumption that capital needs are linearly related to population growth. Under such an assumption, capital investment planning does not address need but rather the cost-effective replication of the existing infrastructure for a larger population.

- standards and quality of life -- since the relationship between the amount of investment and quality of life is difficult to deduce, we rely on a melange of "standards," such as Federal drinking water standards to determine whether water is safe to drink, professional standards to determine how wide a highway should be, and professional judgment to determine how safe a dam is or how often a highway should be resurfaced. Infrastructure investment need and meeting these "standards" then become equivalent, and the relevance of the standards to quality of life is rarely questioned.

- distribution of needs, benefits, and costs -- most infrastructure investment studies assume that needs and benefits are homogeneous even though communities are quite heterogenous as far as condition and

capacity of existing facilities, financing capabilities, and perception of needs. The distribution of costs is usually ignored altogether.

- o revenues vs. institutional intent and capability -- the "gap" between investment requirements and revenues is often the "bottom line" of studies and reports on public infrastructure needs. Once investment need is thus identified, the critical question whether the revenues if realized would be allocated to meet infrastructure needs is rarely raised. Furthermore, if the revenue gap were to be closed, would public agencies be adequately funded to provide the necessary personnel and services required to turn revenues into infrastructure? Identification of need may be the endpoint of analysis, but it is the beginning of the political process that must raise and allocate revenues and the institutional process that is required to spend revenue in a cost-effective manner.

- o impacts and tradeoffs -- the consequences of <u>not</u> investing revenues to meet identified infrastructure needs are acknowledged but rarely analyzed. As it is unlikely that revenues will be sufficient to meet all identified infrastructure needs, an impact analysis that spells out the consequences of not meeting needs is essential if the infrastructure study is to assist decisionmakers. In the Blue Ribbon Panel report, there is no sense of the relative importance of the identified needs. Although these needs were identified through a

variety of assumptions and analytical procedures, once identified as needs they assumed a uniform and monolithic character. Without an impact analysis classification overrides substance, and the identification of need becomes an end in itself.

- the historical and institutional context -- the political history of previous decisions involving infrastructure investments cannot be disregarded when defining future needs. It is not through impartial and rational allocation of funds that infrastructure is built but rather the give and take of political conflict and compromise. No operational definition of need can adequately account for this process.

- physical plant vs. human capital -- infrastructure includes schools and hospitals as well as highways and sewers. With limited revenues, investment becomes a zero-sum game. How are these investment decisions to be made? Is "defining" need really a matter of explicating choices?

- norms and infrastructure -- the existing infrastructure reflects the values of past and current social and political elites. Investment decisions for public infrastructure are inherently normative, and the underlying values are extremely difficult to identify and assess.

These issues make it very difficult to arrive at a deductive, conceptual definition of need for public infrastructure investments. Undoubtedly, there are issues that have not been included in this brief discussion. This discussion should make plain, however, the complexities that await any analysis of investment needs for public infrastructure.

If need cannot be defined deductively, an inductive approach such as that taken by the Blue Ribbon panel remains. This approach, too, reveals difficulty in determining infrastructure investment needs in an analytically consistent way. In the following paragraphs some of the ways in which needs are determined for highways, bridges, and water storage and treatment facilities are discussed to illustrate this difficulty.

## Highways

Highway investment needs, in general, are determined through a complex interaction of Federal and State regulations and standards, professional standards and judgment, and political compromise. Over 95 percent of Colorado's state highways is encompassed by the Federal-aid system, making the administration of Colorado's highways very sensitive to changes in Federal funding, regulations, and standards. The Colorado Department of Highways sets construction priorities in its Five-Year Highway Improvement Program.[1] The construction projects to be included in the HIP are identified by local governments and citizens at public meetings held annually within each

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[1]Colorado Department of Highways, Five-Year Highway Improvement Program, A-95 Version, April 1, 1982. Referred to hereafter as HIP.

engineering district.[1] Local transportation needs thus identified are submitted to the Highway Commission and ranked by the Department according to, among other things, compatibility with State plans and policies, availability of funds in the appropriate funding category, and the appropriate "sufficiency rating"[2] critiera. An equitable geographical distribution of funds is also sought. Construction priorities thus established are adopted by the Commission after a public hearing and after extensive public review and comment.

Construction investment needs are further defined by type of highway. For interstate highways, investment need is defined by the cost to complete the remaining 5% of the interstate system in Colorado still uncompleted. Furthermore, construction must be under contract by 1986 for Colorado to receive Federal matching funds.[3] In the case of interstate highways, then, investment need is defined by the "need" to complete a local link in a national network. The amount and scheduling of expenditures will also be determined to a large extent by Federal requirements concerning local matching funds and by Federal design, engineering, and construction standards.

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[1]The procedure under which the Five-Year Program is to be developed is stipulated in Procedural Directive 1604.2.

[2]"Sufficiency rating" provides a systematic evaluation of the existing condition of a highway and its ability to handle potential traffic demand. The components of the rating are pavement condition, capacity, skid resistance, accident history, and potential hazards. These components are weighted differently for urban and rural highways (e.g., capacity is weighted at 50% for urban areas and 15% for rural areas) to obtain a sufficiency rating.

[3]BRP, Vol. II., p. 124.

A second type of highway is that labeled by the Department of Highways as "essential high-cost, long-term growth" projects.[1] Investment needs for these highways are distinguished by the fact that a significant expenditure of funds over a long period of time will be required. Highways to by-pass the central areas of Ft. Collins and Colorado Springs and the widening of Wolf Creek Pass to four lanes are examples of this type of investment need. In the HIP for 1982-1987, these projects are listed under a "future" column signifying post-1987 funding. According to a Highway Department staff member, these projects are so expensive that any of them would deplete the construction budget for any one year.[2] These needs are, in other words, too expensive to include in a 5-year capital investment budget.

The Office of State Planning and Budgeting (OSPB), on the other hand, included only these high-cost projects in the highway portion of the initial Five-Year Capital Investment Plan.[3] These projects are "high priority" projects necessary to meet "present needs" but for which no funding is "available currently or in the foreseeable future."[4] The OSPB recommended that the State Legislature appropriate $135 million from the General Fund to construct the first usable segments of these projects over the next five years.

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[1] BRP, Vol. II, p. 125.

[2] Interview July 1982.

[3] Office of State Planning and Budgeting, Annual Capital Investment Budget FY 1982-1983, Five-Year Capital Investment Plan, FY 1983-1987, January 1982. Hereafter referred to as CIP.

[4] CIP, p. 56.

The HIP and CIP offer an interesting contrast in capital investment planning and budgeting for highway needs. For the Department of Highways, the essential, high-cost projects are needed but are excluded from its 5-year capital investment budget because they would outstrip anticipated revenues and prevent investments in other needs that were identified, evaluated, and assigned priorities through the Department's established planning and budgeting process for highway construction improvements. Under the OSPB's capital investment plan, these high-cost projects would initiate a major new program of highway construction funded by State revenues. In both cases the projects are the same, and the "need" is unquestioned. In the first case, however, the projects received no designation of priority because they are too expensive. In the second case, the projects were selected because they could not be funded by existing revenue sources and were suitable for launching a new construction program. For this type of highway, then, investment is driven not only by cost and source of revenue but also by program intent. The importance of an impact analysis on not funding these projects is also obvious.

Investments are also needed to maintain existing infrastructure in good working order and to repair or upgrade facilities that have been allowed to deteriorate or are no longer adequate. For highways estimates of maintenance needs are based on Federal regulations and standards, professional standards and practices, and previous experience. Maintenance costs account for about 25 percent of the total annual expenditures of the Highway Department.

Moreover, if interstate construction is excluded, approximately 80 percent of the Department's annual construction budget is devoted to "restoration" and "safety" projects.[1] Should these costs be considered maintenance rather than capital costs? In any case, maintenance needs are an important and growing component of highway expenditures that should not be arbitrarily excluded from studies of capital needs.

## Bridges

Bridges provide a classic example of how neglect of maintenance can lead to disrepair and eventual replacement at high cost. About one-fourth of the bridges in Colorado are "structurally deficient" according to the National Bridge Inspection Standards.[2] The magnitude of disrepair is startling and raises a number of questions. First of all, how relevant are the national standards to the type of traffic and intensity of use in Colorado? What are the relationships between life expectancy of bridges and investments in inspection and repair? Can construction standards and maintenance schedules be correlated for maximum cost-effectiveness of investments? Given the magnitude of the disrepair of bridges in Colorado, how are repair and maintenance priorities to be determined? Identification of need answers one question but raises many more.

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[1] Colorado Annual Highway and Transportation Report, January 1981, p. 66.

[2] CIP, p. 57.

Water Storage and Treatment

The determination of investment needs for water storage provides an interesting contrast to that for highways and bridges. Colorado is a semi-arid state split by the Continental Divide, and investment needs for water storage reflect the political, economic, and legal structures built upon the antecedents of climate and geography. All the rivers run into the sea and outward from Colorado. Four major river systems, the Colorado, Rio Grande, Arkansas, and the South and North Platte, originate in Colorado and serve as important water sources for downstream states. Colorado's use of these waters is limited by an international treaty, nine interstate compacts, and two U.S. Supreme Court decrees.[1] West of the Continental Divide, one million acre-feet of water may be available for appropriation depending upon interpretation of the Colorado River Compact and estimates of "virgin flow" (circa 1930) of the Colorado River. East of the Divide, where over 80 percent of the State's population lives, there are only 375,000 additional acre-feet (in the South Platte basin) available for consumption.[2]

Water is a scarce and valuable commodity in an arid climate, and Colorado has developed a legal system that recognizes water rights as property rights that can be severed from the land and transferred to other locations for other uses. Under Colorado water law, water must be "used" to preserve one's rights to it and is allocated by the private market, by the buyers and sellers of water rights. The principal role of State government is to police this market system. How is public investment need to be determined under such a system?

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[1] BRP, Vol. IV, p. 156.

[2] CIP, p. 2.

The interstate compacts and Supreme Court decrees not only set limits on water use among signatory states but also help to establish a political obligation within each state to consume water up to its authorized limit. Thus, the impetus to capture 100 percent of its compact entitlements seems to be motivated, in part, to avoid the risks of not "capturing" this water, with or without immediate use in mind.[1] What water Colorado doesn't use, other states will, and Colorado "needs" to capture this water to obviate the argument that it doesn't need it.

Capital investment needs for water storage and treatment facilities were also estimated by the Blue Ribbon Panel according to type of use. It was assumed by that Panel that industrial users will rely on private financing to obtain water rights and would not affect public investment needs, although extensive industrial demand for water, such as that projected for the oil shale industry, would make water rights more expensive for other users. Capital investment need for municipal water systems were projected by the Panel on the basis of historical per capita consumption and cost trends. These trends along with population projections were used to derive an estimate of future investment needs to accommodate growth. Rehabilitation and replacement costs for water treatment facilities were estimated even though there were no historical data on these costs.[2] Agriculture consumes about 93% of all water used in Colorado. Most agricultural users, however, cannot compete in the free market for water rights and have benefited from the long history of Federal and State subsidies for agricultural water projects. With

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[1]For example, BRP, Vol. IV, p. 153; and CIP, p. 2.

[2]BRP, Vol. II, p. 160.

the Federal government reducing its funding of such projects, public investment need will be determined by the extent to which Colorado is willing to maintain its historical commitment to subsidize agriculture.[1]

In contrast to the Blue Ribbon Panel, the OSPB estimated capital investment needs for drinking water treatment facilities through a rating system developed by the Colorado Water and Sewer Needs Committee. The Committee is made up of representatives from State agencies (Local Affairs, Health, OSPB), the U.S. Department of Housing and Urban Development, the Colorado Municipal League, and Colorado Counties, Incorporated, and makes its recommendations to the Governor.[2] The rating system is based on the Federal primary drinking water regulations, degree and immediacy of health hazards, adequacy of existing treatment capacity, and adequacy of treatment capacity to meet projected population growth. Needs are rated as category A or B, depending on the immediacy and severity of health hazards or lack of adequate capacity.

In the case of drinking water treatment facilities, investment needs were determined by both Federal standards and, as evidenced by the membership of the Committee, professional and political judgment. Drinking water treatment provides a clear example of how Federal regulations can drive local investment needs. However, there is no Federal or State program specifically designed to assist communities to meet these regulations although local governments may

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[1] BRP, Vol. IV, p. 160

[2] Interview, Department of Health Staff, July 1982.

use funds from several Federal aid programs to upgrade drinking water treatment facilities. In the past, the Colorado Water Conservation Board provided assistance through its Water Construction Fund, but the Legislature in 1981 changed the mandate of the Board to that of capturing all of the State's entitled waters.[1]

Water storage and water treatment provide an example of competing needs for investment funds. The Colorado Legislature established that State priority lies with capturing additional water rather than treating existing supplies to meet Federal drinking water standards. Drinking water treatment also raises a conflict between local fiscal priorities and Federal standards. A staff member of the Department of Local Affairs, which among other things, monitors the financial condition of local governments, stated that residents and officials in many communities would rather risk an occasional bout with diarrhea than take on additional financial burdens.[2] On the other hand, a staff member of the Department of Health pointed out that if Colorado, through the Department of Health, does not adopt treatment regulations for each contaminant identified by the U.S. Environmental Protection Agency (EPA), the State will lose jurisdiction over drinking water standards. Moreover, the E.P.A. is expected to identify 12 to 14 organic contaminants for which Colorado will have to adopt treatment regulations.[3]

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[1] CIP, pp. 106-107.

[2] Interview, July 1982.

[3] Interview, July 1982.

Federal-State jurisdictional considerations further complicate investment need for drinking water treatment facilities. The jurisdictional concern also clouds the more fundamental issue of the relevance of Federal standards to the immediate and long-term health of Colorado citizens who must bear additional investment costs. Although it would seem that drinking water treatment should be a clear case of investments needs determined by health standards, water politics and the politics of enforcement play a significant part in determining these needs.

It seems, then, that need is an elusive concept when applied to capital investments for public infrastructure because need is only apparently generic and, in reality, highly specific to the particular kind of infrastructure under consideration. Moreover, need is very difficult to define deductively, that is, outside of the political, legal, and institutional context through which infrastructure has been built and maintained. On the other hand, if need is approached inductively, one quickly becomes enmeshed in the dynamics of institutional and community politics, the stuff of which infrastructure decisions are made. This brief discussion of problems with both deductive and inductive approaches to defining need should make the reader more aware about the conceptual and definitional difficulties that underlie studies of infrastructure needs.

I.

## INTRODUCTION

### Purpose

Under "New Federalism" state and local governments have absorbed a large proportion of Federal budget cuts as a prelude to a devolution of responsibilities from the Federal government. In 1980, states and cities received only 14 percent of the Federal budget but in 1982 bore 60 percent of the cuts in the Federal budget.[1] New Federalism, even in its incipient form, means not only economic burdens for states and local governments, but also the responsibility to resolve serious equity problems concerning allocation of scarce financial resources among competing needs of their constituents. Local officials in making investment decisions will face all of the issues discussed in the previous section. In short, public infrastructure planning and budgeting will test the abilities of state and local governments to govern.

The 1980's will most likely be a decade in which capital will be scarce, new responsibilities for state and local governments will be defined, and greater cooperation between the private and public sectors will be required. Dialogue among states and between regions of the nation concerning infrastructure needs will broaden understanding about common problems and will help to promote a partnership with the Federal government that is consistent with the responsibilities and capabilities of state and local governments.

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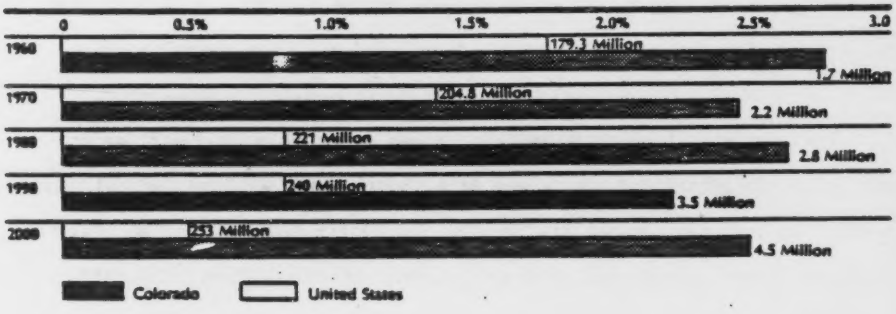
[1]Marshall Kaplan, "New Federalism, Taxes and Cities."....

## Colorado Background

Colorado was chosen as a case study state because it provides an example of a "sun-belt" state that has experienced both the positive and negative effects of rapid growth. Since the early 1960's, Colorado, in both population and economy, has grown at a much faster rate than the nation has as a whole. Between 1960 and 1980, population in Colorado increased by almost 1.2 million, an annual growth rate of 2.5% compared to the national rate of 1%.[1] According to the Blue Ribbon Panel, the State's population is expected to continue growing at a rate twice that of the nation and reach 4.5 million by the year 2000. Figure 1 compares historical and expected population growth in Colorado and the United States.*

Figure 1

Population Growth, U.S. and Colorado
1960-2000




Source: BRP, Vol. I, p. 7.

[1] BRP, Vol. II, p. 24.

*The State Demographer has prepared population projections adjusted for 1980 Census figures. The official 1980 population of Colorado is 2,889,735. The "medium" population projections for 1990 and 2000 are 3,696,500 and 4,512,700, respectively. (Interview, September 1982). It is important that the Panel's projections, which were prepared in 1978, are close to the most recent projections of the State Demographer since many of the Panel's estimate of investment needs are based on historical per capital expenditure trends extrapolated to an expected future population.

From the early 1960's to the severe national recession of 1980, Colorado's economy grew at a sustained, rapid rate, interrupted only by the national recession of 1975. During the 1970's, over half a million jobs were created, and the average annual growth in employment was 3% greater than the national average.[1] In the boom year of 1978, over 90,000 jobs were created, and private employment increased by nearly 10 percent.[2] The State's economy has slowed markedly during the current national recession and has become increasingly vulnerable to fluctuations in the national economy. In the next 20 years, Colorado's economy is expected to continue growing but at a much slower rate than it has enjoyed during the past 20 years.

Growth and prosperity bring with their history of commendable statistics a considerable burden of public facilities and services. Transportation, water, sewer, and waste disposal, just to mention the most basic physical necessities, must keep pace if growth and prosperity are not to overwhelm the host environment that nurtures them. Colorado, in other words, must invest public funds to provide the facilities necessary to sustain growth and to prevent deterioration of services for existing residents. Public facilities, the infrastructure upon which communities as well as nations are built, are as much a part of a people's heritage as are their land and cultural history. Stewardship involves infrastructure as well as wilderness, sewers as well as wild and scenic rivers.

In addition to representing a sun-belt state, Colorado was also chosen for a case study because it has begun to address in a comprehensive and

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[1] BRP, Vol. I, p. 7, and Vol. II, p. 24.

[2] BRP., Vol. II, pp. 20-21.

systematic way the issue of public infrastructure needed to accomodate and sustain economic growth. The National Conference of State Legislatures has identified Colorado's effort to evaluate its infrastructure needs and capital budgeting process as potentially instructive for other states.[1] In September 1979, Governor Lamm created the Governor's Blue Ribbon Panel to study the infrastructure needs that underlie economic and population growth and the costs and funding sources to meet these needs. In July 1981, the Blue Ribbon Panel issued its findings in a 4-volume final report.[2]

## The Blue Ribbon Panel

Governor Lamm's appointment of a panel of prominent public officials and private citizens to address the issue of Colorado's infrastructure needs was an example of pragmatic vision and executive initiative. The Blue Ribbon Panel brought together department heads and legislators from State government, educators, businessmen, labor leaders, and farmers, and the result was not only detailed projections of capital investment needs and revenues over the next 20 years, but also a consensus on the need for a cooperative process between the public and private sectors to delineate and fund infrastructure needs. The sharing of the chairmanship of the Panel by Roy Romer, State Treasurer, and William K. Coors, Chairman of the Adolph Coors Company, symbolized the need for public-private sector cooperation. The Panel met

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[1]Richard V. Watson, Colorado and New York Evaluate Their Infrastructure Needs and Capital Budgeting Processes. Denver: National Conference of State Legislatures, May 1982 (Draft).

[2]The Final Report of the Governor's Blue Ribbon Panel, Colorado: Investing in the Future, July 1981, Vol. I, Findings; Vol. II, Forecasts; Vol. III, Technical Appendices; and Vol. IV, Working Papers.

regularly over an 18-month period to gather and assess information and to develop recommendations concerning a comprehensive capital investment strategy for Colorado.

The Panel made general recommendations concerning capital planning and budgeting and specific recommendations concerning transportation, water supply, and financing. For capital planning, the Panel recommended that uniform economic and demographic growth forecasts be prepared annually to provide a "specific vocabulary for future program planning." The Panel further recommended that these forecasts be revised annually with the involvement of the State agencies affected and in consultation with local governments and the private sector.

To budget for the future, the Panel called for the creation of a forum for public and private investment coordination and capital budgeting. The forum would consist of representatives from the private sector, public interests, local governments, and State government and would report annually on investment needs, options, and priorities. Recommendations on capital investment, tax, and regulatory policies would also be made by the forum. To invest in the future, the Panel recommended that the State create a capital investment fund with a target of $500 million (1980 dollars) to be set aside over the next five years.

The Blue Ribbon Panel's general recommendations are important because they are a result of consensus developed between representatives of the public

and private sectors through discussion and considerations of the State's infrastructure needs. The work of the Panel has developed strong support within the private sector for public investment planning. For example, the Denver Chamber of Commerce established a task force on capital investment planning and has lobbied for the creation of a Central Planning Commission along the lines of the investment planning forum recommended by the Panel.

The response of the public sector has also been positive. In each of the past three sessions of the Legislature, a bill providing a systematic approach to capital investment planning and budgeting has been introduced.[5] Governor Lamm has initiated a five-year capital budgeting process as recommended by the Panel and submitted the FY 1982-1983 Annual Capital Investment Budget and FY 1983-1987 Five-Year Capital Investment Plan to the Legislature in January 1982. This budget and plan will be discussed in more detail later in this case study.

Colorado Case Study

The case study will consider only publicly funded infrastructure needs and will furthermore be limited to the basic physical infrastructure of transportation; water supply, storage, treatment and distribution; sewage treatment; and solid waste disposal. Preparation of the case study began with an examination of the data and analyses contained in the Blue Ribbon Panel report. The work of the Panel was extremely helpful, but much more data were gathered and additional analyses performed in preparing the case study.

The case study will attempt to present the most current information available on needs and revenues for the four categories of infrastructure up to the year 2000. The economic and demographic forecast and methodology through which the Blue Ribbon Panel attempted to derive a consistent statewide estimate of needs and revenues will be described briefly. The body of the case study consists of a detailed assessment of the four infrastructure categories. This assessment will be based on the Blue Ribbon Panel reports as well as many other reports and interviews. In the concluding section, some of the public policy issues raised by the case study are discussed.

It is hoped that the case study will inform readers about Colorado's infrastructure needs and revenues and the public policy questions that will have to be resolved to meet these needs. The Center for Public-Private Sector Cooperation also hopes that the case study will stimulate public discussion concerning the need to develop a systematic procedure to evaluate and fund infrastructure needs.

## II

## COLORADO NEEDS, REVENUES, AND EXPENDITURES

### Background

To provide a consistent basis for its projections of infrastructure needs and revenues, the Blue Ribbon Panel relied on an economic and demographic forecast prepared by the Office of State Planning and Budgeting (OSPB).[1] The OSPB forecast provided estimates of population, inflation, and economic growth needed to project demand for government services, availability of revenues, and public investments needed to maintain government services at the level currently provided. The forecast also provided an economic model to assess the effects of alternative assumptions about the future on program demands, revenues, and investment needs.[2]

The OSPB forecast used by the Panel was a "baseline" or "standard" forecast based on a "most likely" set of assumptions about the future. The assumptions were designed to be "conservative" in that no dramatic favorable or unfavorable changes from the present were included. For example, no major disruption of the world status quo and more restrictive fiscal and monetary policies than those of the past 20 years were two of these assumptions.* The Blue Ribbon Panel also claimed that the forecast did not incorporate value judgments about public policy objectives, although it is obvious that the

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[1]This section is based on BRP, Vol. II, pp. 2, 70-71, 74.

[2]See BRP, Vol. III, pp. 1-28.

*The Reagan Administration's budget cutting and New Federalism initiatives mark a drastic departure from federal-state relationships established over the previous 20 years. The effects of this change are noted in the sections discussing each of the infrastructure components.

"current services" approach (discussed later) followed by the Panel implies a judgment about the adequacy and equity of existing facilities and services.

After the key assumptions were established, the national economy was forecast using material prepared by Chase Econometrics Associates in the second quarter of 1980. Colorado's economy was forecast using an OSPB economic model that assumes that local economic activity is related to national economic activity and can be projected through appropriate modification of national economic variables. The model includes a demographic section to project program costs that are affected by population growth and to develop estimates of changes in the age mix of the population and in household formation for use in the economic equations.

The economic forecast set a base from which the OSPB estimated the ability of State government to fund projected infrastructure needs. On the basis of the economic forecast, the OSPB projected State revenues and expenditures on the further assumption that services provided by the State would continue at the same relative level** and tax structures would not change. The mix of goods and services presently delivered by the State was frozen, and the cost of that mix was projected by estimating the impacts of inflation and population changes. State programs would continue to serve the

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**As the case study will show, the Blue Ribbon Panel did not adhere to this assumption in a consistent manner when projecting investment need in individual infrastructure categories -- this is one of the hazards of the "inductive" approach taken by the Panel.

same relative share of target populations. Through its "current services" projections the OSPB attempted to show the cost of doing in the future what State government does today.[1] Under the current services approach, productivity of State agencies as well as level of service is assumed to remain constant.

Revenues

Revenue projections were made by the OSPB based on long-term estimates of economic activity and population growth change consistent with the Colorado economic forecast described earlier. The revenue estimates were also consistent with the current services approach in that it was assumed that there would be no changes in current tax law affecting General Fund revenues, non-General Fund revenue sources (cash and Federal funds) would continue to meet their current share of costs, general revenue sharing for states if continued would not exceed loss of categorical aid, and sales tax transfers to augment highway financing will not be renewed after authorization for such transfer expires in 1986. Under these assumptions, about 60 percent of the projected growth in revenues were attributed to inflation, 20 percent to population increase, and the remaining 20 percent to increases in real income.[2]

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[1] BRP, Vol. II, p. 110.

[2] BRP, Vol. II, p. 77.

Expenditures

Projections of State expenditures were made by sorting individual agency programs into seven categories defined on the basis of a price index and whether or not the programs were affected by population change. For example, general operations, such as the programs of the OSPB, would not be affected by population growth and would be expected to follow the general price index for state and local government goods and services. On the other hand, medical programs, such as laboratory services provided by the Department of Health, would be affected by population growth and costs would be expected to follow the price index for medical services. Expenditures were then projected by using long-term estimates for price indices and demographic trend effects applicable to each category.

Applicable State statutory limits[1] on expenditures were factored into the projections as was a baseline level of $26 million per year for capital construction, roughly the level provided by the Legislature in recent years. About 80 percent of the projected growth in expenditures was attributed to inflation and the remaining 20 percent to population growth. Under the current services approach, no new programs or enhancements of existing programs were allowed, and, consequently, no real growth in State spending was projected.[2]

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[1] A 7% per year limit on spending increases and a 4% reserve requirement.

[2] BRP, Vol. II, p. 78.

The so-called "bottom line" of the projections of State revenues and expenditures is the surplus available for the Legislature to appropriate for infrastructure investments. Under the current services projections, a surplus (Table D.1, "Discretionary General Fund," 1980 dollars) of $800 million will accumulate between FY 1981 and FY 1986, and about $6 billion between FY 1981 and FY 2001. These estimates are very rough as they are based on the current services assumptions described above, including no changes in Federal funding for federally assisted State programs.* The $6 billion estimate provides a baseline, however, to calculate to what degree State revenues may match investment needs, assuming the willingness of the Legislature to appropriate the surplus for infrastructure.

## Investment Needs and Revenues

The magnitude of investment required to accommodate growth in Colorado was estimated for the Blue Ribbon Panel by the OSPB for 17 investment areas that included basic physical infrastructure, housing, utilities, and social services. Probable Federal, State, and local revenue sources for each of these areas were also estimated. The Panel did not analyze private revenue streams due to limitations of budget and time.

The investment needs estimates made by the Blue Ribbon Panel were derived from estimates made by State agencies of the capital facilities needed over the period 1981-2001. Many of these estimates were based on the assumption that investment needs are linearly related to population growth, even though

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*As noted earlier, this assumption is a precarious one upon which to base revenue forecasts.

in many investment areas, this relationship is weak and not linear. For example, future municipal water treatment needs will be profoundly affected by the degree to which water conservation is practiced. Investment needs for local governments and special districts, except for the Regional Transportation District in Denver, were omitted due to lack of data. These omissions resulted in a substantial understatement of public capital needs for infrastructure investment. It was also assumed that no significant changes in technology or public attitudes on the relative importance of services would occur. This assumption probably resulted in an overstatement of investment needs.[1]

For each investment area, the Blue Ribbon Panel estimated the availability of non-earmarked revenues by examining the historical patterns of capital expenditures.* It was generally assumed that expenditure patterns provide an indication of the capability and willingness to make capital investments for future infrastructure needs. This is a conservative approach since it assumed no additional taxing or increase in debt capacity over those borne in the past.[2]

In aggregate terms for the period 1981 to 2001, the Blue Ribbon Panel projected total private and public infrastructure investment needs of $92 billion (1980 dollars). Public investment needs were estimated at $22 billion and State funds available for infrastructure investments at $6 billion. To

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[1] BRP, Vol. II, pp. 117-118.

[2] Interview with OSPB staff, July 1982.

*Ear-marked revenues were projected by using the current services approach.

meet projected needs, approximately $16 billion must be derived from Federal and local sources and from additional State sources.

The Panel identified four areas in which public investment needs* will most likely exceed public sources of funds available to meet the needs: highways, water, sewer, and State facilities. A summary of needs and revenues for the first three areas is shown in Table 1.

Table 1

Needs vs. Revenues 1981-2001
($ Billions, Constant 1980)

| | Projected Needs | Probable Revenues Federal | State | Local | Total | Needs Minus Revenues |
|---|---|---|---|---|---|---|
| Highways | | | | | | |
| Water Supply, Storage, Treatment | 3.2 | 1.4 | 0.3 | (2.1)* | 1.7 (3.8) | 1.5 (0.6)** |
| Sewers | 1.1 | 0.02 | 0.1 | 0.5 | 0.62 | 0.5 |

*Potential Local Revenues

**$600 million excess if local revenues are realized.

Source: BRP, Vol. II, pp. 34-36.

*Based on historical financing patterns, the Panel assumed that about 85% of the total investments needed will be funded by the private sector. The Panel assumed that most of the investments for housing and utilities (except for water and sewer) will be privately funded (BRP, Vol. I., p. 23).

In the next sections, investment needs and revenues availability will be disaggregated and estimated for each of the four infrastructure categories (transportation, water storage and treatment, sewage treatment, and solid waste disposal). To the extent data and information were available, needs and revenues for each category were projected for the periods 1983-1987 and 1988-2000.

## III

## TRANSPORTATION

Colorado's transportation system represents a multibillion dollar investment in highways, airports, and railroads, and mass transit facilities. The highway network consists of 74,461 miles of State highways, county roads, and city streets. The highway network is augmented by 106 public airports, 17 with commercial service, and by a rail network of 3,400 miles.[1]

The Blue Ribbon Panel identified transportation as the most immediate and geographically extensive public investment need.[2] Colorado's highway system and its rail, bus, and airline networks are obviously vital for personal mobility and economic activity. In the past, the location of transportation facilities was a critical factor in determining economic development and land use patterns, which, in turn, determined to a large extent other public infrastructure needs. In recent years, however, Colorado's transportation system has been more a respondent to rather than a determinant of growth and economic development. Energy and mineral resource development on the Western Slope, the emergence of Denver as a regional business and financial center, higher energy costs, energy conservation, and deregulation of the transportation industry, to name the obvious factors, are shaping Colorado's transportation needs and revenues.

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[1] Colorado Annual Highway and Transportation Report, January 1981, p. 11.

[2] BRP, Vol. I, p. 12.

## Highways and Bridges

### Background

The heart of Colorado's highway network is the 9,200 miles of State highways that carry 68 percent of all vehicular traffic in the State. Out of the total State highway mileage, 8,870 miles, or 96 percent, are part of the Federal aid system of interstate, primary, secondary, and urban highways, making the administration of Colorado's highways very sensitive to changes in Federal funding and regulations. County roads total 56,400 miles and carry 8 percent of the traffic load, while city streets total 8,500 miles and carry 24 percent of the traffic load.[1]

Travel on the State's highway, road, and street network measured by vehicle miles of travel (VMT)* increased rapidly during the mid-1970's but has leveled off in recent years, an effect probably due to less driving and greater ridesharing in response to higher fuel costs. Another indication of the relative decline of vehicular travel in recent years is that since 1975 VMT and vehicle registration have declined in relation to population growth.

The State highway network is managed by the Colorado Department of Highways under the guidance of the Colorado Highway Commission. Under State law, the Commission adopts its own budget and allocates earmarked revenue from the State Highway Users Trust Fund and from Federal sources for the management, maintenance, and construction of the State highway network. The

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[1] Colorado Annual Highway and Transportation Report, January 1981, p. 15.

*VMT is calculated by multiplying the length of the highway section by its daily vehicle count of traffic volume and summing this product over all sections in the highway.

annual highway budget is an "off-budget" item; that is, it is developed and adopted independently of both the legislative and executive budgeting processes. The Commission is made up of nine citizens appointed by the Governor and confirmed by the State Senate. Eight of the commissioners represent geographic districts while one is a member-at-large.

The annual total expenditures of the State Highway Department has increased from $222.8 million in FY 1977 to an estimated $321.8 million in FY 1981. Table 2 shows that the share of expenditures devoted to construction, maintenance, administration, and patrol have remained relatively constant, with a slight decline for construction and a small increase for maintenance.

Table 2

Actual Expenditures
Colorado Department of Highways
1977 - 1981

| Fiscal Year | Total Expenditures (millions of dollars) | Percentage of Expenditures | | | | |
|---|---|---|---|---|---|---|
| | | Construction | Maintenance | Patrol | Administration | Other |
| 1977 | 222.8 | 68 (151.5)* | 22 (49.0) | 7 | 2 | 1 |
| 1978 | 237.9 | 66 (157.0) | 23 (59.7) | 8 | 2 | 1 |
| 1979 | 252.1 | 63 (158.8) | 25 (63.0) | 8 | 2 | 2 |
| 1980 | 307.8 | 64 (197.0) | 25 (77.0) | 7 | 2 | 2 |
| 1981 (est.) | 321.8 | 62 (199.5) | 25 (80.5) | 8 | 2 | 3 |

* Dollars in Parentheses.

Source: Colorado Annual Highway and Transportation Report, January 1981.

## Investment Needs

Investment needs for the State's highway system are projected separately (including county and municipal streets), bridges, and railroad grade separations. Information sources used in addition to the Blue Ribbon Panel reports were the Highway Department's Five-Year Highway Improvement Plan and an unpublished report on needs,[1] the OSPB's Five-Year Capital Investment Program,[2] a survey of local needs by the Commission on State and Local Government Finance,[3] and interviews with State agency staff. These sources are described briefly in the following paragraphs.*

The HIP outlines a five-year, $876.3 million capital program for highways, bridges, and grade separations on the State system. Annual construction budgets are developed on the basis of the HIP. The HIP reflects highway improvement needs as perceived by primarily by local officials. The needs included in the HIP are costed on a project-by-product basis and are

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[1]Colorado Department of Highways, Five-Year Highway Improvement Program, Adopted August 1, 1982 (referred to hereafter as HIP). The time period of the program is the five fiscal-years between FY 82-83 and FY 86-87. The unpublished report on needs was prepared for legislative hearings and will be referred to hereafter as NR.

[2]Office of State Planning and Budgeting, Annual Capital Investment Budget FY 1982-1983/Five-Year Capital Investment Plan FY 1983-1987, January 1982. Referred to hereafter as CIP.

[3]Commission on State and Local Government Finance, Final Report, 2 vol., August 1982. Hereafter referred to as CSLGF, Vol. I, etc.

*The time periods of the HIP and CIP are the five fiscal years 1982-1983 to 1986-1987. In the BRP, the time periods were given in calendar years; the five-year period of 1983-1987 is used as equivalent to the five fiscal years used in the HIP and CIP. To maintain consistency, estimates for 1981-2001 used in the BRP were converted to 1983-1987 and 1988-2000 estimates in the case study.

constrained by anticipated revenues. The HIP is important to consider in a needs assessment because it is the Department's principal capital investment planning document and shows what the Department reasonably expects to invest in the succeeding five years.

The NR was prepared by Department of Highways staff primarily as a briefing document for State legislators.[1] It contains rough estimates of highway, bridge, and railroad grade separtion needs unconstrained by expected revenues. These estimates were prepared in much the same way as those prepared for the Blue Ribbon Panel. The NR covers the period FY 1981 to FY 1990 and its estimates were updated in 1982.

The OSPB's Five-Year Capital Investment Program is the first attempt by Colorado state government to develop an annual capital investment budget and a five-year investment plan. The budget and plan are the first steps taken by the Lamm administration toward a comprehensive capital investment planning and budgeting process recommended by the Blue Ribbon Panel. The CIP proposes a 5-year investment of $764 million in State funds for highways, water storage facilities, and municipal drinking water and sewage treatment systems.[1] The projects in the program were selected from existing State plans and by consultation with State agencies. The investment areas and projects contained in the CIP provide an indication of the infrastructure investment priorities of the Lamm administration.

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[1]Interview with Department of Highways staff, October 1982.

The Colorado Commission on State and Local Government Finance (CSLGF) was created in July 1981 to examine the structural and financial relationships between State and local governments. Included in its final report are the results of a survey questionnaire on the capital investment expenditures and needs of local government. Responses to that questionnaire by municipal and county governments provided information on capital expenditures and infrastructure investment needs as perceived by local governments.*

These sources of information provide an array of estimates of investmednt needs due to differences in purpose, methodology,** and time period covered. All of these sources will be used to derive a "best estimate" of infrastructure investment needs for highways, bridges, and grade separations.*** The rational for favoring one source over another will be given in the discussion below.

**Highways**

Investment needs for the State highway network and for county and municipal streets will be discussed separately. For the State highway

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[1]CIP, p. 1.

*The needs survey was determined to be methodologically flawed, and the CSLGF has not released the results pending further review.

**One difficulty immediately encountered in using different sources is the variety of inflation rates used to project costs and revenues. Unless otherwise noted, all cost and revenue figures in the case study are constant 1982 dollars. Conversions to 1982 dollars are based on the inflation rate used in the source material.

***The CIP and CSLGF are referred to in estimates of needs and revenues in other infrastructure investment areas.

network, the categories used in the BRP and NR will be followed. These categories are interstate highway construction, "essential high-cost, long-term growth" projects, and "other construction."

Interstate Highways

Investment need for interstate highways will be determined by the cost of completing "local" links in a national network. The Department of Highways has done extensive planning and design for the remaining segments of the interstate system. Consequently, estimates for interstate highway construction can be made with a high degree of confidence. The interstate system through Colorado is about 95 percent complete which provides an impetus to close the gaps in the system.[1] The Department estimates that as of December 31, 1981, the cost of completing the interstate system will be about $642 million.[2] According to the HIP, the Department expects to spend $273 between 1982 and 1987 for interstate highway construction.[3] The investment needed between 1988 and 2000 can be estimated at $369 million (the difference between $642 million and $273 million).

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[1]BRP, Vol. II, p. 124. The Panel raised the issue of whether the gaps in I-70, including the controversial segment through Glenwood Canyon, should be built (BRP, Vol, I, p. 27.).

[2]Interview, Department of Highways staff, August 1982.

[3]HIP, p . All costs quoted from the HIP were converted to 1982 dollars from current dollars inflated 7.6% annually.

Essential, High-cost, Long-term Growth Projects

This category designates projects that require a major commitment of funds over a long period of time. New highways to by-pass the central business districts of Ft. Collins and Colorado Springs and the widening of Wolf Creek Pass (SH 160) are three examples. These projects are located along the rapidly growing Front Range corridor or in heavily travelled mountain passes. For the Blue Ribbon Panel, the Department projected these investment needs at a constant $48 million per year for a total need of $240 million between 1983-87 and $624 million between 1988 - 2000.[1]

The HIP includes projects in this category but with two important differences. First, this need is disaggregated into specific projects and, second, these projects are categorized by the Department as "future" projects outside of the 1982-87 investment period. The Department in its HIP estimated these projects to cost a total of $323 million for the "first usable segments."*

A third version of this category is provided by the CIP. It lists as "essential, high cost, long-term" projects those that have been identified as priorities by the Highway Commission and for which "funding is not available currently or in the foreseeable future."[2] These projects are identical to

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[1] BRP, Vol. II, p. 128. (The same estimates are found in the NR).

[2] CIP, p. 56.

*About half of the estimated cost ($642 million) to complete the interstate highway systems in Colorado.

those similarly described in the HIP, and, under the investment program proposed by the OSPB, the first usable segments of these projects would cost $106 million between 1983 and 1987 and $42 million "beyond 1987".[1]

The reports cited provide disparate estimates of investment required for what appears to be the same category of need. This disparity is due to different methods used to project need and different purposes for the reports. In the BRP and NR, the Department of Highways projected a constant annual dollar amount that, if provided, would enable the Department to build major, new non-interstate highway segments. The Department did not use this category in its HIP, but nine highway projects have been labeled as such and are known within the Department as belonging to this category. These projects are included in the HIP, without specific designation, under a "future" expenditure column. They are excluded from the five-year investment plan because the Department did not expect enough revenue to build them.[2] In the CIP, the OSPB took seven of these nine projects and built a 5-year capital investment plan for highways around them. The highways included in the "essential, long-term growth" category seem to be just the type of projects that should launch the State's initial capital investment program. The cost estimate of the CIP is lower than that of the HIP because it contains seven rather than nine projects.

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[1]CIP, p. 59 (All cost figures quoted from the CIP were converted to 1982 dollars from current dollars inflated at 12.2% annually).

[2]Interview with Department of Highways staff, July 1982.

It is difficult, given these disparate projections, to arrive at a single estimate for investment need in this category. A constant annual amount for a 20-year period is arbitrary at best and could be misleading.[1] Need projections based on costs of specific projects may provided more accurate estimates for those projects but do not accomodate possible additional needs that may exist. For the case study, the Blue Ribbon Panel's estimate of need ($864 million) for the 1988-2000 period will be used because it is the only projection of need that covers the period beyond 1990. For the 1983-1987 period, the CIP estimate will be used because it is based on the costs of the projects that the Department of Highways will most likely build first if funds were available. The investment needs for major, new, non-interstate highways are $106 million for 1983-1987 and $758 million ($864 million - $106 million) for 1988-2000.

Other Construction

The category, "other construction," presents problems of classification as well as definition. This category is used in the BRP and NR to designate non-interstate projects that are to be build using Federal and State matching funds specifically earmarked for these projects. Projects to be built under "interstate transfer" funds, safety projects, projects to be built in urban areas under pass-through funds, and funds for transportation planning are included in this category.* This category does not classify a type of highway

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[1]The estimates for the BRP and NR were "top of the head" guesses. Interview with Department of Highways staff, October 1982.

*The C-470 expressway in southwest Denver metropolitan area is an example of a project to be built with interstate transfer funds.

or a type of need, but it is used to group projects and activities funded by disparate sources. The category is not used in the HIP.

For the Blue Ribbon Panel, the Department estimated need under this category by projecting a constant annual need totaling $234 million for the 1983-1987 period. The Panel's estimate of need for the period 1988-2000 was $225 million.[1] For its own NR, the Department projected investment need in this category at a constant $64.7 million per year.[2] This amount is higher than the estimate prepared for the Blue Ribbon Panel. The NR estimate included $37.9 million in funds that the Department anticipated it would receive for the Interstate Maintenance Program.[3] It was not possible to determine from the BRP whether interstate maintenance funds were included in the estimates of "other construction" needs.

Investment need under the category, "other construction," is difficult to assess. In both the BRP and NR, the estimates included funds, albeit relatively small amounts, for planning and unspecified "safety projects". It is unclear whether investments for these two items should be considered capital investments. Furthermore, the category does not designate a type of investment need but, rather, an amalgam of earmarked funding sources. Need, in this case, is equivalent to the Department of Highway's expectations of funding in certain unrelated Federal highway funding categories.

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[1] BRP, Vol. II, p. 128.

[2] NR, p. 13.

[3] NR, p. 20.

The category "other construction," as used in the BRP and NR exemplifies the problems of definition discussed in the Foreword. The category, as used, however, includes major highway improvement projects, particularly under interstate transfer and urban system pass-through funds. For example, the HIP allocated $187.3 million in interstate transfer funds to the Denver metropolitan area.[1] For the case study, the estimate of the Blue Ribbon Panel, $234 million for 1983 to 1987 and $225 million for 1988 to 2000, will be used. The Panel's estimates cover the investment period of the case study and provides the only basis for choice in an otherwise unclear and poorly document category of need.

Local Streets

The Blue Ribbon Panel estimated new construction needs by determining the rate of increase in the number of miles of county roads and city streets during the period 1976 to 1979 and extrapolating this rate to the period 1981-2001. Counties and municipalities usually require that developers bear a portion of the costs of providing streets, and the Panel assumed that 25 percent will be borne by local government and the remainder by developers. This cost apportionment was based on conversations that the Panel staff held with the Colorado Municipal League and the Colorado Homebuilders Association. The 25 percent portion to be borne by county and city governments amounted to $822 million between 1983 and 2000.[2]

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[1] HIP, p. xiii.

[2] BRP, Vol. II, p. 126.

The Panel's estimates of investment needs for local streets may possibly be overstated since they were derived from a linear extrapolation of existing facilities based on average expansion rates during the late 1970's, a period of rapid economic and population growth in Colorado.[1] Such a procedure of linear numerical extrapolation implies constant, linear physical expansion of the existing local road and street system over a 20-year period. The geographical limitations of such an expansion is obvious. The economic constraint is also evident, if less obvious, when one considers the recent slowdown in housing construction and the growing interest in "in-filling" of developed areas.

The Panel's estimate of needs can be compared to actual local government capital expenditures for streets. The Commission on State and Local Government Finance conducted a survey of county and municipal capital expenditures, revenues, and capital investment needs. Of Colorado's 63 counties, 31, including the City and County of Denver, were not reported in the survey results. The population represented in the county survey was 1,877,401[2] out of the total State population of 2,889,735. The population represented in the survey of municipalities was 1,224,165 out of a statewide municipal population of 2,119,360[3] The response rate on a population basis was 65% for counties and 58% for municipalities. Table 3 summarizes county and city capital expenditures for roads and streets between 1980 and 1982.

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[1] BRP, Vol. IV, pp. 112-116.

[2] Population is total county population, not population residing in unincorporated areas. All numbers are 1980 Census numbers.

[3] Interview, State Demographer's office, August 1982.

Table 3

County and Municipal Capital Expenditures
for Roads and Streets
1980-82
(Millions of Dollars)

| | 1980 | 1981 | 1982 |
|---|---|---|---|
| Counties | 15.4 (23.7)* | 14.4 (22.1) | 32.4 (49.8) |
| Cities | 29.2 (50.3) | 33.4 (57.6) | 42.3 (72.9) |
| TOTAL | 44.6 (74.0) | 47.8 (79.7) | 74.7 (123) |

Source: CSLGF, Vol. II, pp. D-5, D-6.

*Expenditures in parentheses are survey response extrapolated to represent survey population. Survey response on a population basis was 65% for counties and 58% for municipalities.

The Commission also surveyed capital investments in roads and streets that local governments realistically planned (budgeted) to make during the period 1982-86 as well as their estimates for all needed capital investments (unconstrained) and investments needed to bring facilities to a state of good repair (deferred).*

The CSLGF survey results showed that counties representing 65 percent of the total state population and municipalities representing 58 percent of the municipal population spent about $32 million and $42 million, respectively, on roads and streets in 1982. If these survey results are extrapolated to represent the entire survey populations on the assumption that per capita expenditures of the survey samples will hold for the entire survey

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*The results of the capital investment needs survey are being reviewed and have not been released by the Commission.

populations,* 1982 road and street expenditures for counties and municipalities totaled $123 million.

The Blue Ribbon Panel's estimate of $822 million between 1983 and 2000 would mean an average annual investment of about $46 million for local roads and streets. The Panel's projections are much lower than the total local government expenditures for 1982 derived by extrapolation responses to the CSLGF survey results. If the 1982 local expenditures are projected over the 1983-2000 period, a total of $2.2 billion would be invested in county roads and city streets. If uniform annual investment is assumed, $615 million would be needed between 1983-1987 and $1.6 billion between 1998 and 2000.

A comparison of the Blue Ribbon Panel's estimates and those derived from the CLSGF survey shows that cities and counties are investing more than what would be expected from a linear increase in street mileage. If the responses to the survey correctly report capital expenditures, one possible conclusion is that local governments are upgrading the condition of existing streets as well as building new streets.

For the case study, the estimates derived from the survey will be used. The choice is one between estimates derived from an extrapolation of possibly flawed survey results** and estimates derived by projecting a 3-year

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*Such an extrapolation will probably overstate expenditures since the City and County of Denver, which would most likely have a lower per capita expenditure than less populated counties and cities, was not included in the survey responses.

**The survey responses have not been verified and may be in error in regard to the amount and type of expenditures reported as capital expenditures for streets.

historical rate of new street construction over a 20 year period. Although both estimates contain room for error, an estimate based at least partially on empirical data is preferred.

Resurfacing and Reconstruction

The Blue Ribbon Panel estimated resurfacing and reconstruction needs for the State highway system at $299 million for 1983-87 and $763 for 1988-2000.[1] The Department of Highways in its NR estimated these same needs at $470 million for FY 1982-83 to FY 1986-87 and about $1.17 billion for FY 1987-88 to FY 1999-2000.[2] The disparity between the two estimates is due to differences in milage and cost per mile estimates used in the two reports. Table 4 summarizes these differences.

Table 4

Comparison of Resurfacing and Reconstruction Needs
for State Highway System
(1982 Dollars)

| | Blue Ribbon Panel | Needs Report |
|---|---|---|
| **Resurfacing** | | |
| Immediate Backlog | | |
| Miles | 550 | 1,218 |
| Cost/Mile | $ 95,920 | $ 102,220 |
| Total Cost | $ 52,756,000 | $124,504,000 |
| Investment Period | 10 years | 10 years |
| Cost/Year | $ 5,275,600 | $ 12,450,000 |
| Need | | |
| 1983-1987 | $ 26,400,000 | $ 62,500,000 |
| 1988-2000 | $ 26,400,000 | $ 62,500,000 |

Continued....

[1] BRP, Vol. II, p. 128.

[2] NR, p. 15. The FY 1987-88 to FY 1999-2000 estimate was calculated from the cost/mile and resurfacing/reconstruction schedules used by the Department in the NR.

Continued....

Table 4

| | Blue Ribbon Panel | Needs Report |
|---|---|---|
| **Reconstruction** | | |
| Scheduled Maintenance | | |
| Total Highway Mileage | 9,200 | 9,171 |
| Time Between Resurfacing | 20 years | 15 years |
| Cost/Mile | $ 95,920 | $ 102,220 |
| Resurfacing Mileage | 8,650 | 7,953 |
| Total Cost | $830,000,000 | $813,000,000 |
| Cost/Year | $ 41,500,000 | $ 54,200,000 |
| Need | | |
| 1983-1987 | $207,500,000 | $271,000,000 |
| 1988-2000 | $540,000,000 | $704,000,000 |
| Miles | 400 | 720 |
| Total Cost | $ 653,500 | $ 753,200 |
| Cost/Mile | $261,000,000 | $542,000,000 |
| Investment Period | 20 years | 20 years |
| Cost/Year | $ 13,100,000 | $ 27,100,000 |
| Need | | |
| 1983-1987 | $ 65,500,000 | $136,000,000 |
| 1988-2000 | $197,000,000 | $405,000,000 |
| **Total** | | |
| Resurfacing and Reconstruction | | |
| 1983-1987 | $299,400,000 | $469,500,000 |
| 1988-2000 | $763,400,000 | $1,171,500,000 |

Sources: BRP, Vol. II, p. 124; NR, p. 15.

In constrast to the NR, the Department of Highways categorized resurfacing and reconstruction under two different categories in the HIP. Reconstruction needs could not be isolated from the HIP in a manner that would permit comparison with the BRP and NR.[1] Resurfacing costs in the HIP are estimated at $92.5 million for the FY 1982-83 to FY 1986-87 period.[2] This cost estimate falls about half way in between the BRP and NR estimates.

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[1] HIP, p. x.

[2] HIP, p. 9.

Table 4 shows that estimates of investment need for resurfacing and reconstruction will vary greatly depending on the standards used to determine when and how often highways must be resurfaced or reconstructed and upon the cost per mile assumed. For the case study, the more recent NR estimates will be used.

Resurfacing needs for local streets were derived by the Blue Ribbon Panel by assuming that only existing streets would have to be resurfaced during the next 20 years. The Panel also assumed an average cost of $80,000 per mile for resurfacing. Under these assumptions, the Panel estimated that a total investment of $230 million will be required for resurfacing county roads and municipal streets between 1983 and 2000.[1] If uniform annual investment of $12.8 million is also assumed, the investment need for resurfacing local streets will be $63.9 for 1983-87 and $1[illegible]6 million for 1988-2000.

The total investment need for resurfacing and reconstruction of the State highway system and resurfacing local streets will be $533 million for 1983-87 and $1.34 billion for 1988-2000. The BRP estimates for local streets did not include costs for repair. Local investment needs for this category are probably understated.

Bridges

Bridges are an integral part of the State highway network and are a source of growing concern. Increasing truck traffic combined with the demand

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[1] BRP, Vol. II, pp. 125-126.

for higher weight limits and deregulation of the trucking industry will lead to further and more rapid deterioration of bridges.

According to the Blue Ribbon Panel, there is a backlog of 138 bridges on the State highway network that need to be replaced to conform with Federal standards.[1] The Panel estimated that the average replacement cost would be $1.1 million per bridge, and elimination of the backlog would take 10 years. Under this cost and replacement schedule, the total investment needed is $151.8 million. Annual investment need is $15.1 million. Investment needed would be $75.9 million for both the 1983-87 and 1988-2000 periods. In addition to be backlog of deficient bridge, the Panel estimated that an annual investment of $34.7 million would be required to keep the condition of bridges on the State highway system within Federal standards over the next 20 years. This investment need will amount of $173 million between 1983 to 1987 and $450 million between 1988 and 2000. The total investment required for bridges on the state system was estimated by the Panel at $249 million between 1983-1987 and $526 million between 1988 and 2000.

For the NR, the Department of Highways identified a backlog of 117 deficient structures (115 bridges and 2 viaducts) on the State system.[2] All of the bridges have a "sufficiency rating" of less than 50. According to the Department, the average replacement cost per bridge is $721,743, and that for a viaduct $28,952,247. The total cost for bridge and viaduct replacement will be about $141 million. Under a replacement period of 10 years, the Department

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[1]This paragraph is based on BRP, Vol. II, p. 124.

[2]This and the next paragraph are based on NR, p. 19.

projected an annual investment need of $14.1 million. If a uniform annual investment schedule is assumed, the investment needed is $70.5 million for both 1983 to 1987 and 1988 to 2000.

The Departmemt also identified 675 structures that are adequate but are anticipated to become deficient during the next 10 years. Some of the factors upon which the Department based this estimate were: age (material deterioration), effects of changes in legal load limits upon design load, increases in average daily traffic, changes in crossing alignment, waterway adequacy, and an average design life of 50 years. The Department used an average structure cost of $721,743 and an investment period of 10 years to derive a total cost of $487 million and an annual investment need of $48.7 million. If a uniform annual investment schedule is assumed, the investment required is $243.5 million for both the 1983-1987 and 1988-2000 periods. The total investment need estimated by the Department is $314 million for both the 1983-1987 and 1988-2000 periods.

A third estimate of bridge replacement needs was made by the OSPB in its CIP.[1] The OSPB relied upon the National Bridge Inspection Standards of December 1981 to identify 1,693 structurally deficient bridges on both the State highway and local street systems. The OSPB estimated the cost of replacing all of these deficient bridges at $394 million. In its CIP, the OSPB proposed to the Legislature that it appropriated $48.4 million between FY 1982-1983 to FY 1986-1987 to rebuild 170 bridges. Of these bridges, 17 would be on the State system, 19 in urban areas, and 124 on the county system.

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[1]This paragraph is based on CIP, p. 57.

The OSPB's estimates are much lower than those found in BRP and NR. If 1,693 bridges can be replaced at a total cost of $394 million, the average cost per bridge is only $232,700. The average bridge replacement cost assumed by the OSPB is less than one-fourth of the average cost assumed by the Blue Ribbon Panel for bridges on the State system and about one-third that assumed by the Department of Highways in the NR.. Under the OSPB's investment proposal for 1983-1987, the average bridge replacement cost will be $284,700.

One explanation for the disparity in average bridge replacement costs is that the largest number of deficient bridges in the OSPB's inventory was located on the county road system in Eastern Colorado. County bridges in this part of Colorado do not carry as much traffic as those on the State system in general and should be less expensive in design and material costs. At any rate, bridge replacement costs used in the BRP and NR are not directly comparable to that in the CIP since the former two address only bridges on the State highway system while the latter includes bridges on both the State and local systems.

In its HIP, the Department of Highways project an expenditure of $92.5 for bridge replacement and rehabilitation during the FY 1982-83 to FY 1986-87 period. It was not possible to determine an average bridge replacement cost from the data provided in the HIP. Replacement cost ranged from $228,000 for a bridge in rural eastern El Paso County to $48 million for a viaduct in Denver.

The Blue Ribbon Panel identified bridges on the local street system that should be replaced from an inventory conducted by the Department of Highways.[1] Of the 4,100 bridges on the local system 820 should be replaced immediately. At an average bridge replacement cost of $289,400, the cost of removing this backlog of deficient bridges will be $237 million.

Under an investment period of 20 years, the cost will be $59.3 million for 1983-1987 and $154.2 million for 1988-2000. The Panel estimated that 750 new bridges will be required by the year 2000 at a cost of $225 million. The Panel derived this estimate by assuming that the existing ratio of number of bridges to miles of road will hold for the additional road and street milage expected to be built by the year 2000.*

The Panel estimated that of the 3,280 bridges that are structurally sufficient, 40 percent, or 1,312 bridges will become structurally deficient within the next 20 years. Using the same average replacement cost of $289,400 per bridge, the Panel estimated that $380 million will be needed. The annual investment needed will be $18.98 million. The investment needed will be $94.9 million for 1983-1987 and $246.7 million for 1988-2000. An average design life of 50 years was used to derive this estimate.

The total cost for bridge construction and replacement for the local system during 1983-2000 derived from the Panel's estimates is $758 million. The investment needed will be $210 million for 1983-1987 and $547 million for

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[1]This paragraph is based on BRP, Vol. II, p. 126.

*The Panel noted that no data exist to confirm or refute this assumption (BRP, Vol. II, p. 126).

1988-2000. The annual investment needed will be $18.98 million. The investment needed will be $94.9 million for 1983-1987 and $246.7 million for 1988-2000. If a uniform annual investment is assumed, the annual investment required will be about $42 million between 1983 and 2000.

In the CSLGF survey, local government also reported expenditures for capital investments in bridges. Table 5 summarizes these expenditures.

**Table 5**

**County and Municipal Capital Expenditures for Bridges 1980-82 (Millions of Dollars)**

| | 1980 | 1981 | 1982 |
|---|---|---|---|
| Counties | 1.9 (2.9)* | 2.2 (3.4) | 5.9 (9.1) |
| Cities | 3.7 (6.4) | 4.7 (8.1) | 6.2 (10.7) |
| **Total** | **5.6 (9.3)** | **6.9 (11.5)** | **12.1 (19.8)** |

**Source:** CSLGF, Vol. II, pp. D-5, D-6.

*Expenditures in parenthese are survey response extrapolated to represent survey population. Survey response on a population basis was 65% for counties and 58% for municipalities.

If the 1982 capital expenditures are projected as uniform annual expenditure, local government expenditures of $99 million between 1983 and 1987 and $257 million between 1988 and 2000 can be estimated. These

expenditure projections are much lower than the investment needs projected by the Blue Ribbon Panel. Counties and cities that in 1982 spent less than $20 million for capital investment in its bridges will be hard pressed to invest $42 million annually to meet the need projected by the Panel.

The discussion on investment needs for bridges is summarized in Table 6. Both the BRP and NR did not include need for new bridges on the State highway system in its investment projections. This omission may lead to an understatement of investment needs for bridges on the State highway system. For the case study, the estimates contained in the NR will be used for the State system. These estimates were updated in 1982 and reflect the most recent need estimates prepared by the Department of Highways. For the local system, the Blue Ribbon Panel estimates were the only ones available. To summarize the discussion on bridges, the total investment need for both the State and local systems is estimated at $454 million for 1983-87 and $790 million for 1988-2000.

**Table 6**

**Comparison of Number of Bridges**
**(1982 Dollars)**

| | Blue Ribbon Panel | Needs Report | CIP |
|---|---|---|---|
| **State System** | | | |
| Deficient Bridges (Backlog) | 128 | 117 | |
| Cost per Bridge | $ 1,100,000 | $ 721,743 | |
| Total Cost | $151,800,000 | $141,000,000 | |
| Investment Period | 10 years | 10 years | |
| Cost/Year | $ 15,180,000 | $ 14,100,000 | |
| Need | | | |
| 1983-1987 | $ 75,900,000 | $ 70,500,000 | |
| 1988-2000 | $ 75,900,000 | $ 70,500,000 | |
| Total | $151,800,000 | $141,000,000 | |

Continued....

Table 6

continued....

| | Blue Ribbon Panel | Needs Report | CIP |
|---|---|---|---|
| Anticipated Deficient Bridges | N/A | 675 | |
| Cost per Bridge | N/A | $ 721,743 | |
| Total Cost | $728,000,000 | $487,000,000 | |
| Investment Period | 21 years | 10 years | |
| Cost/Year | $ 34,650,000 | $ 48,700,000 | |
| Need | | | |
| 1983-1987 | $173,250,000 | $243,500,000 | |
| 1988-2000 | $450,450,000 | $243,500,000 | |
| Total | $623,700,000 | $487,000,000 | |
| **Total State System** | **$775,500,000** | **$628,000,000** | |
| **Local System** | | | |
| Deficient Bridges (Backlog) | 820 | | |
| Cost per Bridge | $ 289,400 | | |
| Total Cost | $237,300,000 | | |
| Investment Period | 20 years | | |
| Cost/Year | $ 11,865,000 | | |
| Need | | | |
| 1983-1987 | $ 59,325,000 | | |
| 1988-2000 | $154,245,000 | | |
| Total | $213,570,000 | | |
| Anticipated Deficient Bridges | 1,312 | | |
| Cost per Bridge | $ 289,400 | | |
| Total Cost | $379,700,000 | | |
| Investment Period | 20 years | | |
| Cost/Year | $ 18,980,000 | | |
| Need | | | |
| 1983-1987 | $ 94,900,000 | | |
| 1988-2000 | $246,700,000 | | |
| Total | $341,600,000 | | |
| New Bridges | 750 | | |
| Cost per Bridge | $ 299,750 | | |
| Total Cost | $224,800,000 | | |
| Investment Period | 20 years | | |
| Cost/Year | $ 11,240,000 | | |
| Need | | | |
| 1983-1987 | $ 56,200,000 | | |
| 1988-2000 | $146,120,000 | | |
| Total | $202,320,000 | | |
| **Total Local System** | | | |
| 1983-1987 | $210,425,000 | | |
| 1988-2000 | $547,065,000 | | |
| **Total** | **$757,490,000** | | |

Continued....

Table 6

continued....

| | Blue Ribbon Panel | Needs Report | CIP |
|---|---|---|---|
| **Statewide System** | | | |
| Deficient Bridges (Backlog) | | | 1,693 |
| Cost per Bridge | | | $ 232,700 |
| Total Cost | | | $344,000,000 |

**Railroad Grade Separations**

Increased demand for Western coal has increased rail shipment of coal within and through Colorado. Colorado coal imports and exports increased from 5.6 million tons in 1974 to 9.0 million tons in 1977.[1]

The movement of 110 unit-car trains through communities has created both traffic hazards and serious inconvenience for motorists. Grade separations at major intersections of rail and vehicular traffic involving underpasses or overpasses have been identified by the Department of Highways as a major public investment need.

The Blue Ribbon Panel identified 84 railroad crossings needing grade separation, including 26 on the State highway network and projected that 30 more grade separations will be needed by 1985.[2] The Panel assumed that 5% of the cost will be paid by railroad companies and estimated the total public investment need of $216 million between 1983 and 1987 and $216 million between 1988 and 2000.

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[1] Colorado State Rail Plan, p. V-23.

[2] This paragraph is based on BRP, Vol. II, p. 128.

In the NR, the Department of Highways also identified 84 crossings that need grade separations.[1] The Department used an "exposure factor" criterion to determine need.* Of these 84 crossings, 25 were identified as being on the State highway system. The Department estimated that it will cost $93.4 million to construct these 25 grade separations at an average cost of $3,737,000 per crossing. The Department also identified 53 crossings that will require grade separation by 1985, 30 of which are on the State system. Using the same average cost per crossing, the Department estimated that it will cost $112.1 million to construct these 30 grade separations. The Department assumed an investment period of 10 years. The total investment need will be $224.2 million. The annual investment need will be $20.5 million.

The discussion on grade separation need is summarized in Table 7.

**Table 7**
**Comparison of Grade Separation Needs**
**(1982 Dollars)**

| | Blue Ribbon Panel | Needs Report |
|---|---|---|
| **Number of Separations (Backlog)** | 84 | 84 |
| State System | 26 | 25 |
| Cost/Separation | $ 3,956,000 | $ 3,737,000 |
| Total Cost | $102,850,000 | $ 93,400,000 |
| Investment Period | 10 years | 10 years |
| Cost/Year | $ 10,285,000 | $ 9,340,000 |
| Need | | |
| 1983-1987 | $ 48,860,000* | $ 46,700,000 |
| 1988-2000 | $ 48,860,000* | $ 46,700,000 |
| Local System | 58 | 59 |
| Cost/Separation | $ 3,956,000 | $ N/A |

Continued....

[1]This paragraph is based on NR, p. 18.

*Exposure factor is determined by multiplying average daily traffic by the number of trains using the crossing in a 24-hour period (NR, p. 18).

Continued....

Table 7

| | Blue Ribbon Panel | Needs Report |
|---|---|---|
| Total Cost | $229,450,000 | N/A |
| Investment Period | 10 years | N/A |
| Cost/Year | $ 22,945,000 | |
| Need | | |
| 1983-1987 | $108,000,000* | N/A |
| 1988-2000 | $108,000,000* | N/A |
| **Number of Separations Anticipated** | N/A | 53 |
| State System | 30 | 30 |
| Cost/Separation | $ 3,956,000 | $ 3,737,000 |
| Total Cost | $118,680,000 | $112,100,000 |
| Investment Period | 10 years | 10 years |
| Cost/Year | $ 11,868,000 | $ 11,210,000 |
| Need | | |
| 1983-1987 | $ 59,340,000 | $ 56,050,000 |
| 1988-2000 | $ 59,340,000 | $ 56,050,000 |
| Local System | N/A | 23** |
| **Total** | | |
| 1983-1987 | $216,200,000 | $112,100,000*** |
| 1988-2000 | $216,200,000 | $112,100,000*** |
| TOTAL | $432,400,000 | $224,200,000*** |

*Excludes 5% of cost assumed to be paid by railroad company.

**The NR did not include cost estimates for grade separations on the local street system.

***Needs for State highway system only.

Neither the BRP nor NR provided estimates for future grade separations that may be needed on the local street system. Both estimates probably understate total investment needs for grade separations. For the case study, the estimate found in the BRP will be used. The BRP and NR did not differ substantially in either the number of grade separations needed or in the cost per separation, and the BRP included estimates for grade separation presently needed on the local street system.

## Summary

The discussion of investment needs for highways, bridges, and railroad grade separtions is summarized in Table 8. The estimate of investment needs based on an evaluation of the sources used is $7.73 billion for the period 1983 to 2000.

Table 8

Summary of Highway, Bridge, and Railroad
Grade Separation Investment Needs
1983-2000
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Highways | | | |
| Interstate Completion[a] | 273 | 369 | 642 |
| Essential, High Cost Projects | 106[b] | 758[c] | 864 |
| Resurfacing/Repair | 533[e] | 1,340[e] | 1,873 |
| Other Construction | 234[d] | 225[d] | 459 |

Continued....

Continued....

Table 8

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Local Street System(f) | 615 | 1,600 | 2,215 |
| Bridges(g) | 454 | 790 | 1,244 |
| Railroad Grade Separations(d) | 216 | 216 | 432 |
| TOTAL | 2,431 | 5,298 | 7,729 |

(a) Source: Department of Highways staff.

(b) Source: CIP.

(c) Source: Derived from BRP estimates minus CIP estimates for 1983-87.

(d) Source: BRP

(e) Source: NR.

(f) Source: CSLGF.

(g) Source: Derived from NR and BRP (See text).

**Revenues**

Revenues for highway construction and maintenance in Colorado flow in a complex and interwoven way, from Federal, State, and local funding sources. Federal funds for highway construction are derived from the Federal Highway Trust Fund, although other sources such as revenue sharing, community development funds, and mineral leasing fees are important, particularly at the local level. Federal funds for grade separation are provided under Section 203 of the Federal-Aid Highway Act of 1976. These funds are apportioned 50

percent for grade separations and 50 percent for crossing safety improvements, such as gates and signals.[1] Funds for crossing improvements are also available through the Highway Crossing Protection Fund derived from fees paid by railroads and administered by the Public Utilities Commission (PUC). The fund accumulates about $20,000 per month under the present rates set by the PUC and may be used only when Federal funds are not available.[2]

Local funds are derived from property taxes and assessments, sales tax, traffic fines, fees, and various transfers from the State and other jurisdictions. The discussion of revenues for capital investment in highways will be focused on the state level because it is here where the complexities of funding converge. Also, secondary data on local revenues and capital investments are incomplete.

The major sources of revenues for the construction and maintenance of State highways are the State Highway Users Tax Fund (HUTF) and Federal aid.[3] The HUTF is derived from a 9 cent per gallon tax on motor fuels, vehicle registration and drivers' license fees, and a gross ton-mile tax on truck freight. The fund is apportioned 65 percent to the State, 26 percent to counties, and 9 percent to municipalities. Appropriations from the HUTF are also made to the State Patrol and to other State agencies such as the Public Utilities Commission for trucking regulation and the Department of Revenues to

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[1] Colorado State Rail Plan, p. VI-5.

[2] Interview with Department of Highways staff, July 1982.

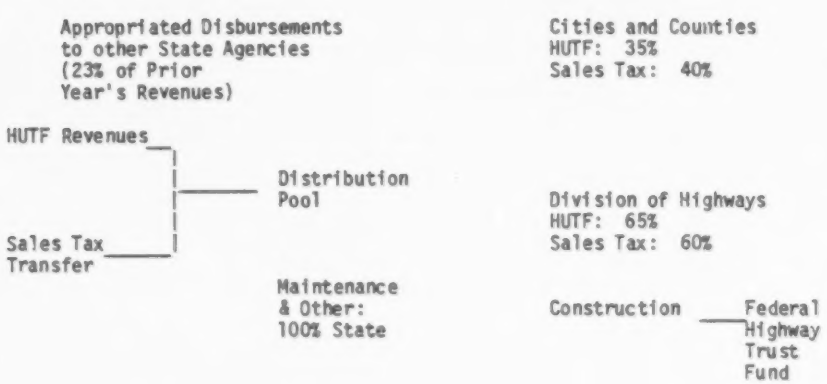
[3] This and the following 5 paragraphs are based on BRP, Vol. II, pp. 87-91.

operate weigh stations. In 1979, the Legislature limited these appropriations to 23% of HUTF revenues of the previous year.

In FY 1981, the HUTF provided $179.2 million. The Legislature augmented highway revenues for FY 1981 by a one-time appropriation of $57.5 million from the General Fund and a transfer of $33 million in sales tax revenues. Federal aid in FY 1981 was $146.6 million.[1] Figure 2 illustrates the revenue and expenditure flows at the State level.

**Figure 2**

**Highways Revenue and Expenditure Flows**




Source: BRP, Vol. II, p. 88.

The Legislature first authorized transferring of sales tax revenues from the General Fund to the HUTF in FY 1980, and, in 1981, authorized continuation

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[1]Colorado Annual Highway and Transportation Report, January 1981, p. 66.

of the transfer through 1986. Between FY 1970 and FY 1980, the average annual growth in total highway funding was 6.8 percent, while that of HUTF revenues was 5.4 percent. Motor fuel tax receipts grew even slower at an annual average of only 4.2 percent over the decade. Moreover, appropriations from the HUTF to other State agencies grew at an average annual rate of 9.4 percent over the same ten years.

The combination of slow growth in revenues and rapid rise in costs resulting in an average annual growth between FY 1970 and FY 1980 of only 2.1 percent for funds to construct and maintain the State highway network. During the same decade, construction costs rose at an average annual rate of 10 percent, and, in terms of real dollars, funding of the State highway system declined. Recent actions taken by the Legislature to raise the gasoline tax from 7 cents to 9 cents per gallon, to provide money from the General Fund to the HUTF, and to limit the appropriation for disbursements to other State agencies reflect its concern about inadequate revenues for highway construction and maintenance. Table 9 summarizes recent revenues from Federal, State, and local sources for capital investment.

Table 9

Revenues for Capital Investment
1977-1981
(Millions of Actual Dollars)

| Intergovernmental Revenue Analysis | 1977 | 1978 | 1979 | 1980* | 1981* | TOTAL |
|---|---|---|---|---|---|---|
| **Federal** | | | | | | |
| Interstate, primary, secondary, and urban | 133.0 | 124.3 | 126.5 | 136.8 | 117.9 | |
| Federal assistance to counties | 4.7 | 8.0 | 10.0 | 13.1 | N/A | |
| Federal assistance to counties | 5.5 | 5.8 | 4.2 | 5.8 | N/A | |
| TOTAL | 143.2 | 138.1 | 140.7 | 155.7 | | |
| **State** | | | | | | |
| Highway Users Tax Fund | 79.6 | 89.8 | 97.8 | 107.1 | N/A | |
| Misc. Revenues (a) | 7.7 | 9.3 | 24.2 | 13.4 | 13.8 | |
| State Transfers to counties | 37.5 | 42.6 | 46.3 | 62.6 | | |
| State Transfers to cities | 23.5 | 27.0 | 33.4 | 44.1 | | |
| Impact assistance (b) for highways (counties and municipal) | | 1.2 | .4 | N/A | | |
| Oil Shale Lease for highways (counties and municipal) | .7 | 1.1 | 2.7 | | | |
| TOTAL | 149.0 | 168.8 | 194.7 | | | |

Continued....

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Table 9 continued....

| Invergovernmental Revenue Analysis | 1977 | 1978 | 1979 | 1980* | 1981* | TOTAL |
|---|---|---|---|---|---|---|
| **Local** | | | | | | |
| Federal Match | | | | | | |
| - counties | .99 | .81 | 1.5 | 0.8 | 0.6 | |
| - cities | 1.5 | 3.3 | 5.3 | 4.7 | 3.6 | |
| TOTAL | 2.49 | 4.11 | 6.8 | 5.5 | 4.2 | |
| **LOCAL SOURCES** | | | | | | |
| County | 33.6 | 35.5 | 34.7 | 42.7 | N/A | |
| City (c) | 51.8 | 62.0 | 72.1 | 84.5 | N/A | |
| TOTAL | 85.4 | 97.5 | 106.8 | 127.2 | | |

Source: BRP, Vol. III, pp. 47-48.

*1980 and 1981 revenues from interview with Department of Highways staff.

(a) State miscellaneous revenues include local match for 1975-79. These figures are identified separately as local Federal match and are included in the State revenue totals in this Table.

(b) These figures are included in State transfers to counties and cities and are not double counted in the State total.

(c) Excludes proceeds from bonds and notes.

## Revenue Projections

The Blue Ribbon Panel's projections for HUTF revenues were based on those of the Department of Highways, modified to reflect actual FY 1980 revenues. Under these projections, HUTF revenues are expected to grow at a rate of 2.8% annually over the next two decades, or about 40% of the rate of growth experienced in the 1970's. This

lower growth rate is about equal to that forecast for Colorado's population between 1980 and 2000.

The 2.8% rate of growth in HUTF revenues was based on the following assumptions:

- o current tax rates will not change beyond the 2 cent increase passed in 1981;
- o authorized sales tax transfers will expire in 1986;
- o slow growth in fuel consumption, due to less driving and more fuel-efficient automobiles; and
- o growth which does occur will be the result of increasing registrations and license fees and increases in gross ton-mile tax receipts.

The HUTF has a fixed-rate tax base and, as a result, is not as elastic as other State revenue sources. A substantial increase in motor fuel consumption would be necessary for HUTF to grow rapidly, and the likelihood of that happening is clearly not very great.

Revenue from State sources that will be available for highway finance is the sum of net HUTF revenues (collections minus disbursements) and special General Fund transfers. With the sales tax transfer ending in 1986, revenues

for highway finance were projected by the Panel to decrease from $269.9 million* in 1983 to $194.2 million in 1987. Revenues for capital investment were projected to diminish even more noticeably. The Panel projected that HUTF funds available for Federal matching will diminish from $11.2 million in 1983 to 0 in 1986. Declining gas tax revenues and inflationary increases in construction costs were cited by the Panel as reasons for this decline in State revenues.[1] From 1986 to 2000, matching money for Federal funds was projected to be available only from local sources. The Panel projected capital investment revenues to total $191 million from 1983 to 1987 and $112 million between 1988 to 2000.

Revenues from Federal sources were projected by the Blue Ribbon Panel by using the existing financing structure, even though changes in this structure have been proposed by the Reagan Administration.[2] These revenues were estimated on the availability of State and local matching funds. The federal-state sharing of highway construction costs has varied widely in recent years, and the Panel used a "mid-range" estimate of 15.5% for the State's share of highway investments to prepare its projections.[3] The Panel projected that annual revenues from Federal sources will diminish from $134

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[1] BRP, Vol. III, p. 41.

[2] BRP, Vol. III, p. 38.

[3] BRP, Vol. II, p. 96.

*Unless otherwise stated, all revenue projections in the case study are in 1982 dollars. The BRP revenue projections were converted from constant 1980 dollars to 1982 dollars by assuming an annual inflation rate of 9.5%.

million in 1983 to $11.5 million for the period 1987 to 2000. The Panel projected revenues from Federal sources to total $323 million between 1983 and 1987 and $214 million between 1988 and 2000

For local sources of revenue between 1983 and 2000, the Panel projected a constant $60 million per year based on the annual average expenditures by counties and cities for right-of-way, engineering, and construction between 1977 and 1979. Revenues projected were $300 million for 1983 to 1987 and $780 million for 1988 to 2000.

The Blue Ribbon Panel's revenue projection for capital investments in highway, bridge, and grade separation need are summarized on Table 10.

Table 10

Capital Investment Revenue Projections
for Highways, Bridges and Railroad
Grade Separations
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Federal | 323 | 214 | 537 |
| State | 191 | 112 | 303 |
| Local | 300 | 780 | 1,080 |
| Total | 814 | 1,106 | 1,920 |

Source: BRP, Vol. III, pp. 42-43.

## Investment Needs versus Revenues

The Blue Ribbon Panel's revenue projections from Federal, State and local sources anticipates about $1.92 billion in revenues from all sources for highway investments between 1983 and 2000 (Table 10). The Panel's projections were the only comprehensive revenue projections available at the time of the case study was being prepared.

The total investment need is estimated for the case study to be $7.73 billion (Table 8). The projected shortage of investment revenue is about $5.81 billion.

## RAILROADS

### Background

Colorado's rail network consists of 3,390 miles of mainline track, 96 percent of which is operated by six major companies: Denver and Rio Grande Western; Union Pacific; Atchison, Topeka and Santa Fe; Burlington Northern; Colorado and Southern Burlington; and Missouri Pacific. In 1979, these companies moved more than 39 million tons of freight that either originated or terminated in Colorado and generated more than $355 million in revenues. Major commodities transported include coal (56.2 percent), food (8.9 percent) and farm products (9.1 percent).[1]

Railroads are the major common carrier in Colorado, and in 1973 accounted for 50 percent of the shipment of goods produced in Colorado.[2] Rail freight movement is concentrated in three north-south and three east-west corridors through Denver and Pueblo.[3] Rail traffic density is extremely light on many segments of the State's rail networks.

Rail passenger service is provided by two Amtrak trains and by the Rio Grande Zephyr that serves Denver and Salt Lake City and points in between. In addition, several special tourist-related services are provided.[4]

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[1] Colorado State Rail Plan, 1980 Update, Vol. I, pp. III.1 - III.21.

[2] Colorado State Rail Plan, January 1979, p. II.13.

[3] Colorado State Rail Plan, p. II.13.

[4] Colorado Annual Highway and Transportation Report, January 1981, p. 22.

## Investment Needs

Investments in railroads, both trackage and rolling stock, will be made almost exclusively by the private sector. Major public investments will be limited to grade separations at intersections with highways and to crossing protection equipment for at-grade highway intersections. These investment needs are discussed in the previous section on highways.

### Branch Line Rehabilitation

Public investments in railroads outside of grade separation and crossing protection equipment will be to help maintain lightly used lines that are deemed vital for the agricultural and manufacturing sectors. In 1982 a $312,300 Federal grant, along with $6,373 in State money and $127,500 in local money, were used to rehabilitate the San Luis Central Railroad (SLC) line between Monte Vista and Center. The SLC carries farm commodities and provides a connection with the Denver and Rio Grande Western at Monte Vista.

In addition to construction assistance, money for rail planning is provided by the Federal government under a 70-30 matching program. In FY 1982, the Highway Department received $107,300 under this program for statewide rail planning.[1] The objectives of the Department in rail planning and in managing the railroad assistance program are to preserve and improve the quality of service on branch lines.

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[1]Interview with Highway Department staff, July 1982.

Grade Separation and Relocation of Lines for Coal Trains

The increased rail shipment of coal discussed earlier has created conflict between vehicular and rail traffic that has become acute in some communities. Traffic safety and delay are major issues facing rail transportation, particularly as more coal is transported from northwest Colorado, Wyoming, and Utah across Colorado to Texas and the Midwest.

In anticipation of increased coal train traffic, the Blue Ribbon Panel projected investment needs for railroad-highway separation in addition to those discussed earlier in connection with highways. These needs were categorized under minimum and maximum programs.[1] Under the minimum program, $113 million is projected for the mini-Urban Program, a 10-year project to improve highway-railroad crossings along the Front Range. Railroad companies are expected to pay 5 percent of the costs, and the State share of the Program will be $108 million spread over 10 years.

The maximum program adds the Sterling-Rock project that would include relocation and upgrading of railroad lines to bypass the Denver metropolitan area at a cost of $231 million. Railroad companies are expected to pay 8 percent of the costs, and the project is expected to take 12 years to complete. The public investment for the Sterling-Rock project would be $213 million, and, when added to the cost of the mini-urban program, results in a public investment need of $321 million for the maximum program.

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[1]This paragraph is based on BRP, Vol. II, p. 261.

## Revenues

The Blue Ribbon Panel did not make revenue projections for public sector capital investments in railroad grade separation and crossing protection. The Panel assumed that all revenues for such investments included in the projections for highway revenues.[1]

In 1982, about $446,000 in Federal, State, and local revenues were used for branch line rehabilitation. If this level of expenditure is maintained, about $8 million can be expected to be invested between 1983 and 2000. The Department expects to receive $400,000 to $600,000 in Federal assistance per year through FY 1985 under the Local Rail Assistance Program of the FRA. If Federal funding for the program is cut as recommended by the Reagan Administration, the Department expects to receive about $300,000 annually. Federal funding for the program beyond FY 1985 is uncertain.

## Needs versus Revenues

Public investment in rail transportation outside of grade separation and at-grade crossing protection is uncertain but also very small compared to highway investments. The $8 million investment need projected for branch line rehabilitation between 1983 and 2000 is based on expected funding. The Blue Ribbon Panel's projection of $321 million for the period 1983-2000 under its "maximum program" to route coal trains around the Denver metropolitan area is most likely the limit of public investment need for railroads. The relocation

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[1] BRP, Vol. II, p. 134.

and upgrading of railroad lines were not included in the highway investment needs assessed by the Panel. Between 1983 and 2000, public investment need for railroads, outside of grade separations accomodated under highway investments, will exceed revenues by $231 million, the cost of the Sterling-Rock portion of the maximum program.

## PUBLIC SURFACE TRANSPORTATION

### Background

In addition to intercity commercial bus lines and taxicab companies, there are five public transportation systems in Colorado. These systems offer public bus service in Colorado Springs, Pueblo, Greeley, Fort Collins, and the five-county Denver Metropolitan area. Table 11 shows the total annual patronage on these systems. Small bus systems also operate in Aspen, Vail, and Steamboat Sprins.

Table 11

**Total Annual Patronage on Urban Transit Systems**

| | 1978 | 1979 | 1980 |
|---|---|---|---|
| Denver | 43,100,000* | 38,100,000 | 43,100,000 |
| Colorado Springs | 1,540,000 | 1,930,000 | 2,400,000 |
| Pueblo | 1,085,000 | 1,381,000 | 1,540,000 |
| Fort Collins | 127,000 | 227,000 | 282,000 |
| Greeley | 57,000 | 72,000 | 382,000** |

**Source:** Colorado Annual Transportation and Highway Report, January 1981.

*reflects Federally funded off-peak free fare program.

**system enlarged in 1980.

About 145,900 passenger trips are made daily on these systems, 92 percent of them in the Denver metropolitan service area of the Regional Transportation District (RTD). Table 12 shows that public transit accommodates a small but rising share of daily commuter trips.

Table 12

Statewide Commuter Trends

| | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|
| Daily Commuter Trips | 1,890,000 | 1,970,000 | 2,060,000 | 2,140,000 |
| Percent by Auto | 97.4 | 97.3 | 97.2 | 96.9 |
| Percent by Transit | 2.6 | 2.7 | 2.8 | 3.1 |

Source: Colorado Annual Highway and Transportation Report, January 1981.

The transit system operated by the RTD consists of a 700-vehicle bus fleet, park-n-ride stations, and the 16th Street Mall in the heart of the central business district of Denver. In addition, the RTD has proposed construction of a 73-mile light-rail transit system. A proposal to impose a 3/4 percent sales tax to fund a light-rail system was turned down by voters in the District in 1980. Another proposal to fund a light-rail system may be placed on the ballot in 1983.

## Investment Needs

Investment needs for public surface transportation will be discussed separately for the Regional Transportation District, which plans to build a $2

billion* light-rail system in Denver, and the four other public transit operations in Colorado that provide limited municipal bus service. For the small, municipal systems, the major financial problems are operating deficits created by high wage and fuel costs. Annual deficits are about $1 million in Colorado Springs and $475,000 in Pueblo and are growing at a rate of 12 to 18 percent per year.[1]

Although capital investment may improve productivity and reduce operating costs, the major need for the small, municipal systems will be subsidies to offset operating costs. The Panel estimated investment needs for public surface transportation outside of the Denver area at $21.6 million for 1983 to 1987 and $56.8 million for 1988 to 2000.[2] Table 13 summarizes these needs.

Table 13

Public Surface Transportation Needs
in Areas Other than Denver
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Colorado Springs | 7.36 | 40.3 | 47.7 |
| Pueblo | 1.60 | 2.59 | 4.19 |
| Other Areas | 12.6 | 13.9 | 25.5 |
| Total | 21.6 | 56.8 | 77.4 |

Source: BRP, Vol. II, p. 148.

(Totals may not add exactly due to rounding)

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[1] BRP, Vol. II, p. 146.

[2] BRP, Vol. II, p. 148.

*Constant 1982 dollars; $5.8 billion in "current dollars" under the inflation rate of 9.5% per year used by the RTD. All costs in this section were converted to 1982 dollars by applying the inflation rate used by the RTD.

The Blue Ribbon Panel estimated that 95 percent of capital investment in public surface transportation during the next 20 years will take place in the Denver metropolitan area. Capital investment needs elsewhere in the State will have little effect upon the overall public investment need.[1]

The Regional Transportation District (RTD) is in the final year of a 5-year improvement program funded by a $45 million bond issued in 1977 and $152.4 million in Federal grants. Construction of the 16th Street Mall in downtown Denver; expansion and modernization of the bus fleet from 640 to 744 vehicles; construction of maintenance facilities, park-n-ride stations, bus shelters, and other improvements; and acquisition of right-of-way in four primary transit corridors were part of this improvement program.[2] For the period 1983 to 2000, the Panel projected RTD's total investment needs at $1.7 billion. The Panel's projections of RTD's investment needs for the 1983-2000 period are summarized in Table 14.

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[1] BRP, Vol. II, p. 264.

[2] BRP, Vol. II, p. 146.

Table 14

Denver Area Public Surface Transportation Needs
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Transit System Excluding Light Rail | 96.3 | 615 | 711 |
| Light Rail | 412 | 578 | 990* |
| Total | 508 | 1,193 | 1,701 |

Sources: BRP, Vol. II, p. 148; BRP, Vol. III, p. 63.

*The Blue Ribbon Panel projected that construction of the light-rail system would take place during the 1981 -1996 investment period. The Panel's estimate for total cost of the light-rail system was $1.08 billion (BRP, Vol. II, p. 147).

The Panel's estimate of total statewide investment need (from Tables 13 and 14) was $530 million for 1983 to 1987 and $1.25 billion for 1988-2000. The total investment need for 1983-2000 was estimated by the Panel at $1.78 billion.

The Blue Ribbon Panel's estimate of investment needs can be compared to RTD's recent capital expenditures and budgeted capital outlays. Table 15 shows RTD's actual capital expenditures for 1978 through 1980 and budgeted capital expenditures for 1982.

Table 15

RTD Capital Expenditures and Budgets
1978-1982
(Millions of Dollars)

| 1978 | 1979 | 1980 | 1981 | 1982 | Total |
|---|---|---|---|---|---|
| 38.8 | 19.1 | 26.8 | 47.5 | 43.4 | 175.6 |
| (60.0)* | (26.5) | (33.3) | (53.0) | | (216.2) |

*(1982 Dollars in Parentheses).

Source: Interview with RTD staff, July 1982.

For the 5-year period, 1978-1982, RTD capital expenditures totaled about $216 million. For the 5-year period 1983-1987, RTD plans to make about $137 million in capital investments (Table 16).

Table 16

RTD Capital Program 1983-1987
(Millions of Dollars Escalated at 11.5%)

| | 1983 | 1984 | 1985 | 1986 | 1987 | Total |
|---|---|---|---|---|---|---|
| Federal | 38.053 | 17.536 | 19.174 | 18.787 | 23.626 | 127.286 |
| Local | 20.488 | 7.948 | 8.505 | 10.018 | 8.758 | 55.727 |
| TOTAL | 58.541 | 25.484 | 27.779 | 38.805 | 32.384 | 182.993 |
| | (52.503)* | (20.498) | (20.039) | (25.107) | (18.791) | (136.938) |

*(1982 Dollars in parentheses)

Source: RTD, 1983-87 Transit Development Program.

RTD's capital investments for transit improvement other than the light-rail system during the period 1988-2000 are difficult to project.

Between 1983 and 1987, RTD plans to invest about $38 million for fleet modernization and expansion and about $6.0 million for capital support projects (bus pads, bus shelters, etc.) and capital support equipment (communication equipment, shop tools, computer equipment, major spares, etc.).[1] The other elements of RTD's capital program -- the 16th Street Mall, maintenance and storage facilities, park-n-ride facilities, transit centers -- are expected to be in place by the end of 1986.[2] The capital investment needs that can be expected beyond 1987 will most likely be for fleet modernization and capital support projects and equipment.

In summary, RTD's planned investment capital program that can be expected to continue beyond 1987 is about $44 million, or about $8.8 million annually. If this annual amount is projected over the 1988-2000 period, capital investment can be estimated to be about $114.4 million for the RTD system excluding the light-rail proposal.

The major capital investment planned by RTD in the period 1983-2000 is, of course, a light-rail transit system to serve the Denver metropolitan area. The RTD has evaluated a number of design alternatives along primary corridors. The investment estimates discussed below are for a system that lies about midway between the least and most expensive design alternatives. The system is proposed to be funded by an additional sales tax levy of 1% and no bond revenue.

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[1]RTD, 1983-1987 Transit Development Program.

[2]RTD, 1982-1986 Transit Development Program, p. 15.

The total construction cost for the system is projected at about $2.0 billion with completion planned in 2002. The investment projected is $393.8 million for 1983-1987 and $1.53 billion for the period 1988-2000. The RTD projects that a 1% additional sales tax levy will pay for the light-rail system and will accrue a substantial balance by 2002.[1] The RTD estimates that annual revenues will be $149.5 million and annual operating cost will be $128.9 million in 2002.[2] The total investment that the RTD is likely to make in its bus and proposed light-rail system can be estimated at about $2.43 billion. The discussion on capital investment estimates derived from RTD documents and interviews with RTD staff is summarized in Table 17.

**Table 17**

**Summary of RTD Capital Investment Estimates (Millions of 1982 Dollars)**

| | 1978-1982 | 1983-1987 | 1987-2000 | Total |
|---|---|---|---|---|
| Bus System | 259.6 | 136.9 | 114.4 | 510.9 |
| Light Rail System | --- | 393.8 | 1,530 | 1,924 |
| TOTAL | 259.6 | 530.7 | 1,644 | 2,435 |

The Blue Ribbon Panel's estimates for public surface transportation investment needs in the Denver area and the estimate derived from the RTD's planned capital investments differ substantially. For a light-rail system, the difference in total cost ($1.08 billion vs $2.0 billion) is due to the escalation of cost between 1978, when the Panel made its estimate, and 1982

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[1]RTD, unpublished draft report, July 1982.

[2]Interview with RTD staff, July 1982.

when the RTD prepared its estimate. For the case-study, the RTD's estimate will be used because it is based on more recent cost estimates as well as a more likely construction schedule.

The Panel's estimates for RTD's capital investment needs for public surface transportation other than the light-rail system was substantially larger than that derived from RTD's planned capital expenditures. This difference ($711 million vs $251 million) is more difficult to reconcile. The smaller estimate is constrained by anticipated revenue while the larger is not. If the two estimates had been made on a comparable basis, the difference would point toward the shortfall between need and revenue. However, there was insufficient documentation in the BRP to determine whether its projections of need were comparable to those of the RTD.

For the case study, estimates of investment needs for Denver's bus system will be based on the RTD's planned capital expenditures rather than on the Blue Ribbon Panel's projections. The former probably reflects better what bus ridership is likely to be given the assumed construction of a light-rail system. As long as light-rail transit is to be the major public investment in public surface transportation, the bus system will play an auxillary role in both transit and investment planning.

The capital investment needs for public surface transportation is summarized in **Table 18.** Although investment needs for bus and light-rail systems were discussed separately, the two, of course, will function in an

integrated way. Moreover, if the light-rail system is rejected again by the voters of the District, it is likely that larger capital investments will be made by the RTD in its bus system.

Table 18

Capital Investment Needs for
Public Surface Transportation
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Denver | | | |
| Bus System | 137 | 114 | 251 |
| Light Rail Transit | 394 | 1,530 | 1,924 |
| Colorado Springs | 7.36 | 40.3 | 47.7 |
| Pueblo | 1.60 | 2.59 | 4.19 |
| Other Areas | 12.6 | 13.9 | 26.5 |
| **Total** | **553** | **1,701** | **2,254** |

(Totals may not add exactly due to rounding)

The total investment need for public surface transportation needs in Colorado between 1983 and 2000 can be estimated at $2.25 billion.

## Revenues

Capital expenditures for RTD's light-rail system were projected on a pay-as-you-go basis with revenues being provide by a 1 percent sales tax levy. Similarly, RTD's 1983-87 transit development program for its bus system

was based on anticipated Federal grants and expected income for local sources such as sales tax receipts and operating revenues. No State funds have been received in the past, and none are anticipated. The RTD projects Federal capital grants to decline but to continue through 1986.[1] Table 19 shows RTD's revenue projections for 1982-1986. Revenue projections beyond 1986 were not available from the RTD at the time the case study was being prepared.

Table 19

**RTD Projected Revenues 1982-1986**
**(Millions of Dollars Escalated at 11.5%)**

| Revenues | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|
| Sales Tax | 63.10 | 69.83 | 77.73 | 86.90 | 97.59 |
| Federal Grants-Capital | 21.86 | 28.31 | 11.36 | 6.94 | 0.41 |
| Federal Grants-Technical Assistance | 0.17 | 0.20 | 0.20 | 0.20 | 0.20 |
| Federal Grants-Operating Assistance | 8.58 | 5.70 | 2.85 | - | - |
| Proceeds from Sales Tax Revenue Bonds, Series 1977 | 8.94 | - | - | - | - |
| Transit Operating Revenues | 28.06 | 30.80 | 33.88 | 37.27 | 40.99 |
| Investment Income | 2.29 | 1.50 | 1.25 | 1.00 | 0.80 |
| Accrued Funds | 18.30 | 37.47 | 32.32 | 25.04 | 18.61 |
| Other Income | 0.14 | 0.27 | 0.32 | 0.45 | 0.60 |
| **Total Revenues** | **151.44** | **174.08 (156.13)*** | **159.91 (128.63)** | **157.80 (113.84)** | **159.20 (103.00)** |

Source: RTD, 1982-1986 Transit Development Program, September 18, 1981.

*1982 Dollars in Parentheses.

[1]RTD, 1982-1986 Transit Development Program, September 18, 1981.

The RTD projected its 1983-1986 revenues to be $501.6 million. For the 1983 to 1986 period, it projected sales tax revenues to increase about 12% per year, Federal capital grants to diminish toward zero, and transit operating revenues to increase about 11% per year. These increases in revenue offset the assumed annual inflation rate of 11.5%. If the 1987 revenue is assumed to be at about the same level as the 1986 revenue, or about $100 million, the total revenue for 1983 to 1987 can be estimated at about $602 million.

If the annual revenue levels of 1986 and 1987, when Federal capital and operating grants were assumed to be zero, are projected to the 1988-2000 period, the revenue for this period can be estimated at about $1.8 billion. For 1983 -1987, the RTD projected capital investment at $136.9 million (Table 16), or about 22.7% of the estimated revenue of $602 million over the same period. If this same percentage of revenue is devoted to capital investment during the period 1988 to 2000, approximately $409 million will be available.

The revenue projections derived from RTD planning documents is shown in Table 20.

**Table 20**

**Revenue Projections for RTD**
**(Millions of 1982 Dollars)**

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| All Revenues | 602 | 1,800 | 2,402 |
| Revenues for Capital Investment | 137 | 409 | 546 |

Revenue projections based on the RTD's planning documents rather than those of the Blue Ribbon Panel will be used in the case study. The RTD planning documents contain more recent estimates of capital investment revenues than those available to the Panel in 1978.

For public transit operations in Colorado Springs and Pueblo, additional revenues will be needed to cover operating deficits. Revenues, particularly for capital investments, are problematic. According to the Panel, operating deficits and curtailment of Federal assistance will preclude major capital expenditures after 1992.[1] Revenues for capital investment for Colorado Springs and Pueblo will be very small in comparison to that in the Denver area and will not have a noticeable effect on statewide revenue projections.

## Capital Investment Needs versus Revenues

Given the predominance of travel by automobile in Colorado, it is difficult to project a need for public surface transportation beyond that which the public has been willing to support. The RTD's proposed light-rail transit system provides a good example of how difficult it is to establish need. Transportation planners usually justify the need for mass transit in terms of quality of life, regional land use and development plans, energy conservation, and mobility for all social and economic classes.[2] The refusal by the District's voters in 1980 to levy additional sales tax to build a light

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[1] BRP, Vol. II, p. 147.

[2] RTD, Public Transportation Plan Update, February 1982, p. 3.

rail system has been interpreted by some people as a rejection of light-rail transit and by others as merely a rejection of the financing scheme. Still others have interpreted the lack of traffic jams during the recent strike by RTD bus drivers as a sign that light-rail transit is not needed in Denver.

It is also difficult to estimate capital investment needs outside of the planning process of the responsible operating agency and without independently assessing alternative levels of service that are affordable. Clearly, such an analysis is beyond the scope of this case study. For the purposes of this study, investment needs for public surface transportation will be determined by the financial burden that the public is willing to bear for improved mobility, energy conservation, more coherent regional land use and development, and so forth. The people of the District have so far supported expenditures for light-rail transit planning and right-of-way acquisition. For the case study, a need for light-rail transit will be assumed since construction of a system is under active consideration by the RTD and the electorate. Until a sales tax increase is approved by the District's voters, investment need will exceed revenues by approximately the projected cost of the light-rail system -- $1.6 billion between 1983 and 2000.

The discussion of investment needs and revenues is summarized in Table 21.

Table 21

Summary of Investment Needs and Revenues
Public Surface Transportation
(Millions of 1982 Dollars)

| | Needs | | | Revenues | | | Needs Minus Revenues | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1983-1987 | 1988-2000 | Total | 1983-1987 | 1988-2000 | Total | 1983-1987 | 1988-2000 | Total |
| Denver Area | | | | | | | | | |
| Bus System | 137 | 114 | 251 | 137 | 409 | 546 | 0 | (295) | (295) |
| Light Rail | 394 | 1,530 | 1,924 | --- | --- | --- | 394 | 1,530 | 1,924 |
| Total | 531 | 1,644 | 2,175 | 137 | 409 | 546 | 394 | 1,235 | 1,629 |
| Other Areas | 21.6 | 56.8 | 77.4 | --- | --- | --- | 21.6 | 56.8 | 77.4 |
| **Total** | **552** | **1,700** | **2,252** | **137** | **409** | **546** | **415** | **1,292** | **1,705** |

Based on the discussion above, investment needs for public surface transportation are expected to exceed revenues by $1.7 billion between 1983 and 2000.

## Airports

### Background

The hub of Colorado's air transportation system is Denver's Stapleton International Airport, which handled 91 percent of the 11,700,000 passengers enplaned in Colorado during 1978.[1] Stapleton is the 7th busiest airport in the nation[2] and handles about 55 percent of all passengers and transfers in the Rocky Mountain region. The airport is owned and operated by the City and County of Denver.

Of Colorado's other 106 public airports, 16 receive scheduled commercial service, but only Colorado Springs and Grand Junction receive scheduled interstate commercial service. Table 22 shows the location of these airports and the number of daily flights. The 16 airports shown enplaned 812,700 passengers and 2,900 tons of cargo and mail in 1978.[3]

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[1] BRP, Vol. II, p. 144.

[2] Interview with Stapleton International Airport staff, September 1982.

[3] BRP, Vol. II, p. 139.

Table 22

Location and Frequency of
Commercial Air Service

| Location | No. of Flights | Location | No. of Flights |
|---|---|---|---|
| Colorado Springs | 104 | Grand Junction | 36 |
| Pueblo | 26 | Montrose | 21 |
| Lamar | 4 | Gunnison | 7 |
| Sterling | 4 | Leadville | 4 |
| Ft. Collins | 6 | Aspen | 10 |
| Steamboat Springs | 12 | Cortez | 27 |
| Craig | 8 | Durango | 15 |
| Eagle | 12 | Alamosa | 9 |

**Source:** Colorado Annual Transportation and Highway Report, January 1981.

**Investment Needs**

The major public capital investment need for air transportation in the period 1983-2000 will be for expansion of Stapleton International Airport or for construction of a new Denver regional airport. Passenger traffic at Stapleton is projected to grow from 10.6 million in 1981 to 28.4 million in 2000.[1] Unacceptable airfield congestion and aircraft delays are expected unless major capital investments are made to expand or relocate Stapleton airport.[2]

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[1]Denver Regional Council of Governments (DRCOG) Potential Expansion of Stapleton International Airport into Rocky Mountain Arsenal, Final Report, June 1982, p. 131.

[2]DRCOG, Metro Airport Study: Site Evaluation, Draft, March 1982.

The Blue Ribbon Panel recommended a phased expansion of Stapleton airport onto the adjacent Rocky Mountain Arsenal, a storage depot for chemical warfare weapons that is expected to be declared surplus property by the Federal government. The Panel opposed the construction of a new metropolitan airport because of its much higher cost.[1] The Denver Regional Council of Governments (DRCOG) projected the cost of expanding Stapleton into the Arsenal at $1.6 billion,* excluding the costs of decontamination.[2] Table 23 summarizes development cost estimates for the airport expansion.

Table 23

**Summary of Costs for Expansion of Stapleton Airport (Millions 1982 Dollars)**

| | |
|---|---|
| Land Acquisition | 61.0 |
| Site Development and Airfield Construction | 570.2 |
| Terminal Building Construction | 728.8 |
| Transportation System Construction | 306.7 |
| TOTAL | 1,666.7 |

**Source:** DRCOG, Potential Expansion of Stapleton International Airport into Rocky Mountain Arsenal, Final Report, June 1982, p. 10.

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[1] BRP, Vol. I, p. 30.

[2] The Department of the Army and Shell Chemical Company have spent $40 million on studies and containment measures for hazardous materials. The cost of decontamination will be directly proportioned to the amount of area released by the Army for airport use and the restrictions placed on land use of the parcel released by the Army. Interview with Department of Health staff, September 1982.

*DRCOG's estimate of $1.5 billion in 1981 dollars was converted to 1982 dollars using an annual inflation rate of 9.5%.

The Blue Ribbon Panel projected an investment need of $1.2 billion* for the expansion of Stapleton based on a 1979 study by DRCOG. The Panel's projection of $301.7 million for air transportation needs outside of the Denver area was based on the 1973 State Air Plan, and, according to the Panel, probably underestimated need since it did not anticipate the economic development pattern of Northwest Colorado between 1978 and 1980. If DRCOG's more recent estimate of $1.67 billion for the expansion of Stapleton airport and the Panel's estimate of $302 million for other statewide airport needs are added, an estimate of $1.97 billion for total investment needs between 1983 and 2000 can be made.

**Revenues**

The Blue Ribbon Panel's projected of revenues for capital investment in airports is shown to total $1.51 billion from 1983 to 2000.[1] The Panel's projection assumed that Federal airport assistance will continue at a level of $15 million per year through 1986. Federal airport assistance was $17.1 million in FY 80 and $12.7 million in each of the fiscal years 1981 and 1982.[2] The Panel's revenue projection for local sources was based on historical capital outlay data and upon discussion with local airport officials.[3] Although not explicitly stated, the Panel assumed a greater

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[1] BRP, Vol. II, p. 143.

[2] Harley Frankel and Randy Harrison, "Presentation Before the Interim Committee on New Federalism," n.d., p. 4.

*DRCOG's estimate of $965 million in 1980 dollars was converted to 1982 dollars using an annual escalation rate of 9.5%.

local role in raising revenues under the "de-federalization" of airports by the Reagan administration.[1]

The revenue projections made by the Blue Ribbon Panel are summarized in Table 24.

Table 24

Revenue Projections for Airports
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Federal Sources | 90 | 156 | 246 |
| State Sources | 0 | 0 | 0 |
| Local Sources | 350 | 920 | 1,270 |
| Total | 440 | 1,076 | 1,516 |

Source: BRP, Vol. II, p. 14.

Need versus Revenues

For the 1983-2000 period, investment needs total $1.97 billion while revenues are expected to be $1.51 billion. Need will exceed revenues by about $460 million. The high cost of a new metropolitan airport, estimated by the Panel at $3 billion,[2] makes it unlikely that it will be built, and the alternative of expanding Stapleton airport will be considered in the case

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[1] BRP, Vol. III, p. 58.

[2] BRP, Vol. II, p. 140.

study as the major public investment need for air transportation in Colorado. The proposed expansion of Stapleton, however, has raised vigorous objections from local governments that will be affected,[1] and political as well as fiscal problems must be solved if the expansion is to take place.

## Summary of Transportation Needs and Revenues

The estimates of needs and revenues for transportation discussed separately in the previous pages are summarized on Table 25. The total need for transportation investments between 1983 and 2000 is estimated at $12.33 billion in 1982 dollars. Revenues for the same period are estimated at $3.98 billion, also in 1982 dollars. Under these estimates of investment needs and revenues, a shortage of $8.35 billion is anticipated.

**Table 25**

**Summary of Capital Investment Needs and Revenues for Transportation (Millions of 1982 Dollars)**

| | Needs | | | Revenues | | | Needs Minus Revenues | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1983-87 | 1988-2000 | Total | 1983-87 | 1988-2000 | Total | 1983-87 | 1988-2000 | Total |
| Highways, Bridges, Grade Separations | 2,431 | 5,298 | 7,729 | 814 | 1,106 | 1,920 | 1,617 | 4,192 | 5,809 |
| Railroads | --- | 231 | 231 | --- | --- | --- | --- | --- | 231 |
| Public Surface Transportation | 552 | 1,700 | 2,252 | 137 | 409 | 546 | 415 | 1,192 | 1,706 |
| Airports | --- | --- | 1,970 | --- | --- | 1,510 | --- | --- | 460 |
| TOTAL | | | 12,182 | | | 3,976 | | | 8,206 |

[1] See BRP, Vol. IV, pp. 117-126.

# IV

# WATER SUPPLY, STORAGE, TREATMENT, AND DISTRIBUTION

## Background

Colorado is a semi-arid state where evaporation on the whole exceeds precipitation. It is an irony appreciated by Coloradans that all of Colorado's rivers flow outward from the State and provide important water supplies for many other states. In terms of water as well as geography, Colorado itself is split by the Continental Divide into two provinces, the West Slope where water is more abundant than people and the East Slope where water is scarce and people abound. This division is more than hydrological -- it is a social, political, and economic division that permeates life in Colorado.

Moisture is carried into the State by prevailing westerly or northwesterly winds and falls mostly on the west side of the Continental Divide. The eastern side of the Divide lies in the rain shadow of the Rocky Mountains and is arid, as evidenced by the prevailing natural vegetation of the short-grass prairie. The West Slope, in turn, lies in the economic shadow of Denver and the prairie, and its water resources have gradually been transferred eastward. The Colorado Big-Thompson Project diverts water from the Colorado River basin via tunnels and pumping stations to the South Platte basin for irrigation and municipal uses in northeast Colorado. The Denver Water Board also diverts ever increasing amounts of water from the Colorado basin.

Colorado's climate is not only arid but extremely variable.[1] The amount of precipitation varies by area, by season, and by cycles of wet and dry years. The variation can range from half to twice the normal annual precipitation. Stream runoff also fluctuates substantially from year to year and from month to month within any given year.

Because of this seasonal and cyclical variability in precipitation, reservoirs are needed to capture high spring flows for release later in the year and to store water from year to year. Extensive distribution systems are needed to deliver the water to agricultural, municipal, and industrial users. In Colorado, there are approximately 2,000 reservoirs with a total capacity of about 6.5 million acre-feet. Although no compilation of the State's extensive distribution system has been made, it is estimated that there are several thousand miles of canals and ditches. To provide for municipal and some industrial uses, there are about 700 water treatment facilities.

The amount of water available for consumption in Colorado is also limited by interstate compacts, U.S. Supreme Court decisions, and an international treaty.[2] Since 1922, Colorado has become a party to nine such compacts, and consumption is subject to two Supreme Court decrees.

On the Western Slope, favorable interpretation of the Colorado River Compact, coupled with estimates of virgin flows dating from 1930, indicate

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[1]The following two paragraphs are based on BRP, Vol. II, p. 159.

[2]The following six paragraphs are based on BRP, Vol. I, pp. 30-33.

that up to 1.1 million acre-feet of water per year, on the average, may remain for consumption in Colorado. However, an unfavorable interpretation of the compact, or downward revisions of virgin flow estimates, could result in a substantial reduction in that figure.

East of the Continental Divide, there is little additional water left to consume, given physical and legal limitations and present consumptive uses. The surface water supplies of the Laramie, Arkansas, and Rio Grande river basins are, for all practical purposes, fully utilized. In the South Platte River basin, only a few hundred thousand acre-feet of water per year remain, on the average, for Colorado to consume.

Underground aquifers are also an important source of water in Colorado. The Ogallala aquifer, which underlies much of eastern Colorado, is being pumped at rates which probably will deplete it over the next 25 to 50 years. Depletion is also occurring along the Front Range, where domestic use of the Denver Basin is causing in significant declines in the water table.

Colorado law recognizes water rights as property rights that can be severed from the land and transferred to other uses or locations. Under the doctrine of prior appropriation, water users determine the uses and the geographical locations of use, with the "first in time" being the "first in right." Thus, within the broad definition of "beneficial use" and of the

requirement that there be a "taking of water," an initial appropriator may use water without limitations as to use as long as senior (i.e., earlier priority) water rights are not injured. By the same token, a purchaser of previously appropriated water may transfer the water, in an amount not exceeding the seller's historic consumptive use, to such uses and places as desired, provided only that other vested water rights (those both junior and senior to the right being transferred) are not injured.

The present Colorado water rights system constitutes a private market approach to the allocation of a scarce resource, with government having very little formal authority over use. This market approach "allocates" water to those who will pay the most for its use. Thus, individual water users, each acting to promote individual welfare, decide how water in Colorado will be used.

## Investment Needs

Investment needs will be described under the three major users of water: agriculture, industry, and municipalities.

### Agricultural Water Supply

Under Colorado's free market system water flows uphill toward money, and most farmers cannot compete with municipal and industrial users for new water

supplies. In fact, existing irrigation water is often cited as a "source" for municipal and industrial appropriation. Irrigation constitutes by far the largest use of water in Colorado and accounts for about 93 percent of all water use in the state.[1] State and Federal support for irrigation projects has been a tradition in Colorado and the West, and subsidies for irrigation projects are in effect public investments.

It is difficult to assess the need for additional agricultural water supplies because the amount of land that could be brought under irrigation far exceeds the water available for all uses. Irrigated agriculture is a creature of Federal policy, and the need for additional public investment in water supply projects cannot be determined without unraveling our present system of subsidized agriculture. Recent changes in Federal water policy and growing fiscal problems, it is unlikely that additional agricultural water supplies will be developed unless Colorado assumes a principal role in subsidizing water projects.

Under these circumstances, the Blue Ribbon Panel estimated need by simply assuming that Federal water projects presently authorized or under investigation will be built.[2] Recent changes in Federal fiscal and water policies make this a highly optimistic assumption. The Panel projected an investment need between 1983 and 2000 of $1.1 billion based on a constant annual need of about $60 million. Subsidies will also be required to rehabilitate older reservoirs and water delivery systems. The Panel estimated

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[1] BRP, Vol. II, p. 165.

[2] BRP, Vol. II, p. 161.

that $540 million will be required for rehabilitation between 1983 and 2000,[1] for a total investment need of $1.67 billion for agricultural water storage. These projections are in Table 26.

Table 26

**Capital Investment Needs for Agricultural Water Storage and Supply (Millions of 1982 Dollars)**

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Federal Agricultural Water Projects | 300 | 830 | 1,130 |
| Rehabilitation of Supply Systems | 150 | 390 | 540 |
| Total | 450 | 1,220 | 1,670 |

Source: BRP, Vol. II, p. 163.

The Office of State Planning and Budgeting proposed in its Capital Investment Plan (CIP) -- described earlier in the discussion of highway investment needs -- to invest $602 million between FY 1982 and FY 1987 for agricultural water storage projects, including dam rehabilitation.[2] Another $647 million was proposed for investment during an unspecified period beyond FY 1987. Table 27 summarizes the OSPB's proposal.

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[1] BRP, Vol. II, p. 163. The Panel's projections in 1980 dollars were converted to 1982 dollars by using an annual inflation rate of 9.5%.

[2] CIP, p. 26

Table 27

Water Storage
Capital Investment Budget Request
FY 1982-83 to FY 1986-87
(Millions of 1982 Dollars)

| | 1983-1987 | Beyond 1987 | Total |
|---|---|---|---|
| Agricultural Water Storage | 581 | 645 | 1,226 |
| Dam Rehabilitation | 20.5 | 2.0 | 22.5 |
| Total | 602 | 647 | 1,249 |

Source: CIP, p. 26.

To derive this estimate, the OSPB assumed that of the remaining irrigation projects authorized by Congress, only the Narrows (on the South Platte River near Ft. Morgan) and Animas-La Plata (near Durango) projects will be built within the near future.[1] It estimated the cost of these two projects under a 90-10 Federal-State cost sharing arrangement.[2] The OSPB proposal included four other agricultural storage projects to capture entitled waters in the Colorado Basin that would be financed exclusively by State funds.[3] The OSPB proposal to rehabilitate 34 reservoirs would capture an additional 132,000 acre-feet of water.[4]

As a rough comparison (due to approximations in converting different base years and inflation rates to 1982 dollars), the Blue Ribbon Panel estimated

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[1] CIP, p. 47.

[2] CIP, p. 28.

[3] CIP, p. 38.

[4] CIP, pp. 34, 25.

investment needs for agricultural water storage and reservoir rehabilitation at $1.67 billion for the period 1983-2000, while the OSPB's estimate was about $1.25 billion for 1982 to 1987 and an unspecified period beyond 1987. The difference between these two estimates is due to the larger number of agricultural water storage projects contained in the Panel's projections. For the case study, the OSPB estimates will be used. The OSPB estimates were made on the assumption that only two more Federal water projects will be constructed. In contrast, the Panel assumed that all Federal projects authorized or under investigation in 1978 would be built. Even the OSPB estimate may be overly optimistic given the recent shift in Federal fiscal policies.

**Industrial Water Supply**

The Blue Ribbon Panel found no reliable data upon which to base estimates for investment needs for additional industrial water supplies. The largest capital investment needs will most likely be in the oil shale and steam electric generation industries, and both industries should be able to finance investment needs for water through the private sector.[1]

The OSPB's capital investment plan proposed $347 million for multi-purpose water storage, which included industrial (primary) energy development), municipal, and agricultural uses in unspecified proportions. About 40 percent of this cost was proposed to be borne by the private sector.[2]

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[1] BRP, Vol. II, p. 161.

[2] CIP, p. 5C.

**Municipal Water Supply, Treatment, and Distribution**

The largest demand for additional municipal water supplies will come from Front Range communities, and the scale of this demand will depend on population growth and the extent to which water conservation is practiced.[1] Population on the West Slope was projected to grow rapidly, but the extent and rate of this growth will depend on the uncertain economics of the oil shale industry.*

Municipal water systems can be divided into two major components: raw water diversion, storage, and delivery facilities; and water treatment facilities, including those required for treated water storage and distribution. The Blue Ribbon Panel found that, as a broad generalization, existing raw water supply, treatment, and distribution systems were adequate to accommodate anticipated growth through 1986.[2] There is, however, an immediate need to improve rural domestic water supply systems outside of the Front Range urban corridor, particularly in areas where energy development is taking place.

To estimate the investment required by projected population growth, the Panel assumed that capital costs for diversion, storage, delivery, and treatment of water are linearly related to population and to annual yield of water. The Panel acknowledged that such linearity does not in fact exist as

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[1] BRP, Vol. I, p. 33.

[2] The following three paragraphs are based on BRP, Vol. II, pp. 159-160.

*The sudden closure of the multi-billion Colony project by Exxon in May 1982 emphasizes this uncertainty.

these costs depend on water source, location relative to point-of-use, amount of treatment needed, and so forth. Capital costs for diversion, storage, and delivery can range from about $200 to over $2,500 per acre-foot of annual yield.

The Panel's cost assumptions were based on the experience of the Colorado Water Conservation Board (CWCB) and the Federal Water and Power Resources Service. Capital costs for treatment facilities also vary widely, and the cost estimate used by the Panel was determined from the average cost of building treatment facilities found in CWCB records. Based on these assumptions, the Panel projected municipal water supply investment needs to be approximately $1.2 billion between 1983 and 2000.

In addition to capital investments for new systems to provide additional water for future population growth, the existing physical plant (both raw water and treatment facilities) will need rehabilitation or replacement in the years ahead. The Panel found that no data exist to estimate the magnitude of those capital investments and assumed that $30 million would be needed each year for a total of $540 million between 1983 and 2000.

The Panel's projected capital investments for municipal water supply systems over the period 1983-2000 are summarized in Table 28. The total investment need projected by the Panel for the period 1983-2000 was $1.57 billion.

Table 28

**Capital Investment Needs for Municipal Water Supply (Millions of 1982 Dollars)**

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Water Supply, Storage Treatment and Distribution | 272 | 760 | 1,032 |
| Rehabilitation of Water Supply System | 150 | 390 | 540 |
| Total | 422 | 1,150 | 1,572 |

Source: BRP, Vol. II, p. 163.

The OSPB identified investment needs for municipal drinking water systems in its 5-year Capital Investment Plan. These needs were based on an evaluation of facilities against a priority rating scale used by the Colorado Water and Sewer Needs Committee. This rating scale is shown below.

| | |
|---|---|
| A Category: | Immediate Needs, Construction Required Within 3-5 Years. |
| A-1 | Demonstrated health hazards |
| A-2 | Violation of the primary drinking water regulations (PDWR) in a manner that has immediate health effects |
| A-3 | Inadequate supply of water to meet the reasonable needs of the current population (150 gallons per capita per day) |

| | |
|---|---|
| **B Category:** | Longer-Term/Emerging Needs, Construction Required Within 5-10 Years |
| B-1 | Potential health hazard (existing condition will result in a health hazard if certain other events occur) |
| B-2 | Violation of the PDWR in a manner that results in a long-term health effect |
| B-3 | Growth projections indicate that the current water supply will not meet the reasonable needs of the projected population within five years |
| C Category: | No Known Health Hazard, Violation of Regulations, or Projected Supply Problems Within Five Years |

The Committee identified 84 communities with water systems having immediate, or "A" category, needs. The OSPB proposed a 50% matching grant program to assist municipalities meet the mandates of the Safe Drinking Water Act. The total program (both State and local shares) would cost $53.6 million between FY 1982 and FY 1987 and would enable all municipalities with a Category A need to meet safe drinking water standards.[1] Longer-term needs (those beyond 5 years and rated as "B" category needs) have been identified by the Committee, but costs have not been determined for most of these needs.[2] The Colorado Water Needs Categorization List contains 86 municipalities with a "B" category need.

Investment needs for agricultural and municipal water systems are summarized in Table 29.

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[1]CIP, p. 107.

[2]Colorado Department of Health, Colorado Water Needs Categorization List, October 1981, and unpublished corrections, August 1982.

Table 29

Summary of Capital Investment Needs for
Agricultural and Municipal Water Systems
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Agricultural Water Supply and Storage (a) | 602 | 645 | 1,247 |
| Municipal Water Supply Storage, Treatment, and Distribtuion (b) | 326 | 444 | 790 |
| Total | 928 | 1,089 | 2,017 |

(a) Source: CIP.

(b) Source: BRP estimates for municipal water supply, storage, treatment and distribution plus CIP estimates for upgrading of municipal systems in order to meet Federal drinking water standards.

The estimates for municipal water systems in Table 29 were derived from two sources. The OSPB's estimate for rehabilitation of municipal water systems ($53.6 million) was determined on a facility-by-facility basis and should be more reliable than the Blue Ribbon Panel's estimate which was based on the projection of a constant annual sum. For municipal water supply, storage, treatment and distribution, the OSBP did not address the need for additional facilities created by population growth. Therefore, the Blue Ribbon Panel estimate ($272 million) was used for this portion of municipal investment need. The sum derived for the 1983-1987 period was $326 million.

A similar procedure was used to derive an estimate of $444 million for the 1988-2000 period by using the OSPB estimate of $53.8 million to approximate the investment required to meet Category B needs and the Panel's estimate of $390 million for additional water supply, storage, treatment, and distribution facilities.

**Revenues**

For the period 1983-1987, the Blue Ribbon Panel projected $1.34 billion in total revenues with $697 million (52%) from Federal sources, $42 million (3%) from State sources, and $600 million (44%) from local sources.[1] The OSPB's projections of revenue sources relied more heavily upon State sources. For its 5-year capital investment plan for water storage and municipal water systems, the OSPB projected total revenues of $963 million with approximately $381 million (39%) from Federal sources (all for water storage), $300 million (31%) from State sources, $156 million (16%) from local sources, and $126 million (13%) from private sources.[2] Table 30 summarizes the two projections in approximately equivalent 1982 dollars.

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[1] BRP, Vol. II, p. 164.

[2] CIP, p. 23.

Table 30

Comparision of Revenue Projections
(Millions of 1982 Dollars)

| | 1983-1987 | | 1988-2000 | |
|---|---|---|---|---|
| | BRP | CIP | BRP | CIP* |
| Federal | 697 | 381 | 652 | --- |
| State | 42 | 300 | 280 | --- |
| Local | 600 | 156 | 1,300 | --- |
| Private | 0 | 126 | 0 | --- |
| Total | 1,339 | 963 | 2,232 | --- |

*The OSPB projected revenues for an unspecified period "beyond 1987".

Federal revenue sources are at best uncertain. The Panel's revenue estimates assumed that Federal funding will average about $120 million each year through the 1982-87 period and will continue to 1992. The OSPB projections assumed that the Narrows and Animas-La Plata projects will be funded by the Federal government on a 90-10 cost sharing basis with the State. In either case, it is evident that revenues to build additional large water storage projects for agricultural use will continue to depend upon Federal water and fiscal policies. Federal revenue sources beyond 1987 are even more uncertain, but it is probably safe to assume, as the Panel did, that revenues will diminish drastically. For the period 1988-2000, the Panel's estimate for revenue from Federal sources was about $652 million.

State revenue sources play a very significant part in the OSPB's estimates as about one-third of the projected need for water storage and treatment will be funded by the State. Of this one-third, about 55% would come from the General Fund, 35% from the Severance Tax Trust Fund, 8% from the Water Resources and Power Development Authority (WRPDA) created in 1981 by the Legislature, and 2 percent from the Colorado Water Conservation Board (CWCB) Construction Fund.[1] General Fund sources available for these investments depend upon budget surpluses which, in turn, depend upon Colorado's revenues and expenditures during the 1982-87 period. Severance Tax Trust Fund revenues (about $138 million for water projects) will depend upon the level of activity in the State's mining industry. The WRPDA, which was funded by the Legislature at $30 million, and the CWCB fund sources are more certain but provide a relatively minor proportion of the revenues.

Local revenue sources were projected at $125 million per year for 1983-1987 by the Panel based on average capital outlay by cities and counties between 1973 and 1978.[2] This projection seems too high when compared to the CSLGF survey of capital expenditures by counties and municipalities for water supply, storage, treatment, and distribution between 1980 and 1982 shown in Table 31.

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[1] CIP, p. 23.

[2] BRP, Vol. III, p. 87.

Table 31

Local Government Capital Expenditures for Water Supply, Storage, Treatment and Distribution 1980-1982 (Millions of Dollars)

| | 1980 | 1981 | 1982 | Total |
|---|---|---|---|---|
| Counties | 0.41<br>(0.63)* | 0.03<br>(0.05) | 0.054<br>(0.08) | 0.49<br>(0.76) |
| Municipalities | 54.6<br>( 84) | 79.7<br>(123) | 66.4<br>( 102) | 201<br>(309) |
| TOTAL | 55.0<br>( 85) | 79.7<br>(123) | 66.5<br>( 102) | 201<br>(310) |

Source: CSLGF, Vol II, pp. D-5, D-6.

* Expenditures in parentheses are those of the population survey respondents projected over the entire survey population. (Response rate: counties 65%, municipalities 58%).

The CSLGF survey results extrapolated to represent the survey population, show that capital expenditures by local governments averaged about $100 million per year.

On the other hand, the OSPB proposed that about $30 million should be the local share to meet the immediate needs for drinking water systems between 1983 and 1987.[1] The local share of costs under the OSPB proposed will average about $6 million per year to meet all Category A needs. Under the assumption discussed previously that all Category B needs can be met for about the same cost as meeting Category A needs, local sources of revenues

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[1] CIP, p. 12.

for the 1983-1987 period will provide about $12 million per year. This level of revenue will be the minimum required to meet Federal drinking water standards.

For the case study, a revenue estimate between that needed to meet minimum requirements and that derived from the CSLGF survey will be used. This middle estimate of local revenue is $50 million per year. This is a conservative estimate as it assumes no new revenue sources beyond those available to local governments during 1980 to 1982. The revenue projections used in the case study are summarized in Table 32. This revenue projection assumes no Federal funds for local drinking water systems and State funding at $8.8 million per year as recommended by the OSPB.

Table 32

**Summary of Revenue Estimates for Capital Investment in Water Systems (Millions of 1982 Dollars)**

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| Agricultural Systems | 458(a) | 500(b) | 958 |
| Municipal Systems(c) | 292 | 764 | 1,056 |

Source: (a)CIP, pp. 11-12.

(b)BRP, Vol. III, pp. 85-89.

(c)CSLGF, and CIP.

## Needs versus Revenues

### Agricultural Water Supply

In examining projected investment needs against projected revenues for agricultural water storage and distribution systems, it is evident that "need" is defined by State policy rather than by economic necessity.[1] It is Colorado's policy to capture all of the water to which it is legally entitled, and investment needs are defined by the fiscal limits within which this policy can be practiced. The cost of capturing an additional 500,000 acre-feet (about 1/3 of the remaining water available for consumption in Colorado) was estimated by the OSPB at about $1.6 billion.[2] The cost of capturing the remaining two-thirds of available water will probably be at least $3.2 billion.

The response of the Legislature to the OSPB's proposed investment plans will indicate to what extent the State is willing to invest General Fund surpluses and other revenues to put its policy into effect. Any "gap" between need and revenue will be a result of a public policy decision on how quickly and to what extent the State should attempt to capture water it feels legally entitled to take. A decision to capture all of the State's entitled waters will create a gap in the neighborhood of $4 billion.

For the case study, the investment program proposed by the OSPB will be used. It is based on more recent information and relies less heavily than the Blue Ribbon Panel's projections on the continuation of previous Federal water and fiscal policies that have changed drastically since 1978.

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[1] CIP, p. 2.

[2] CIP, pp. 2, 26.

Municipal Water Storage, Treatment and Distribution

For municipal water systems, investment needs will be driven by Federal drinking water standards. There is an acute need to upgrade treatment facilities.

The OSPB estimated that about $54 million in State and local funds will be required to remedy the most immediate and acute problems in municipal drinking water systems. This estimate excluded problems that may arise due to population growth in the next 5 years. Since there is about an equal number of communities with a "B" category need classification, it is probably safe to assume that at least an equal amount of revenue will be required to address these needs within the next 5 to 10 years. Under this assumption, the total need for rehabilitation and construction of treatment systems will be about $108 million for the period FY 1982 - FY 1987.

The investment needs projected by the OSPB will be used for the 1983-1987 period. These needs were determined through an inventory of municipal water treatment facilities and are more reliable than the Blue Ribbon Panel's estimates which were projections of assumed per capita costs for water treatment. For example, the Panel estimated that an annual investment of about $30 million would be required between 1983 and 1987 to rehabilitate municipal water systems. The OSPB's inventory, on the other hand, showed that an investment of about $54 million during the same period of time will remedy the immediate problems in existing municipal systems.

The capital investment need for municipal water systems between 1983 and 2000 derived from the CIP and BRP was $770 million. The revenue estimate derived from the CIP and CSLGF for the same period was $1.05 billion (Table 32). These needs and revenue estimates result in an aggregate surplus of about $286 million for municipal drinking water systems. A preliminary conclusion ofthis case study is that local governments should be able to meet capital investment needs for drinking water systems if the State provides assistance as proposed by the OSPB.

Estimates of needs and revenues beyond 1988 are conjectural. For drinking water, Federal standards and the way these standards are enforced will play an important role in determining investment needs. For agricultural water, Federal and State fiscal policies will be decisive in determing need. The Blue Ribbon Panel's projections of revenues for agricultural water projects were the only ones available and will be used for the case study. Table 33 summarizes investment needs and revenues for agricultural and municipal water systems. Industrial needs were assumed to be privately financed.

Table 33

Summary of Needs and Revenues for Water
1983 - 2000
(Millions of 1982 Dollars)

| | Needs | | | Revenues | | | Needs Minus Revenues |
|---|---|---|---|---|---|---|---|
| | 1983-87 | 1988-2000 | Total | 1983-87 | 1988-2000 | Total | |
| Agricultural Systems[a] | 602 | 645 | 1,247 | 458 | 500 | 958 | 289 |
| Municipal Systems | 326 | 444 | 770 | 292 | 764 | 1,056 | (286) |
| TOTAL | 928 | 1,089 | 2,017 | 750 | 1,264 | 2,014 | 3 |

This analysis of capital investment needs and revenues for agricultural and municipal water systems shows a deficit of about $3 million for the period 1983 to 2000. This projected deficit is not meaningful within the limits of accuracy of the case study. The minimal deficit is due to an estimate of aggregate revenues available at the local level for capital investment in drinking water supply, storage, treatment, and distribution. An aggregate estimate that revenues will meet needs does not, of course, preclude revenue shortfalls in individual communities. Revenue projections for capital investment in agricultural water systems relied heavily on State sources such as severance tax and General Fund surpluses. Revenues from these sources are becoming more problematic even since the CIP was released in January 1982.

V

## SEWAGE TREATMENT SYSTEMS

### Background

Colorado's 377 municipal sewage treatment systems have a total treatment capacity of 392 million gallons per day.[1] According to the Blue Ribbon Panel, additional treatment capacity and sewer lines will be needed in the existing urban areas along the Front Range and in areas where the State's energy, mineral, and recreational resources will be developed. In addition, many communities will have to upgrade treatment systems to meet discharge standards. These standards were established by the Federal Water Pollution Control Act and are enforced by the U.S. Environmental Protection Agency (EPA) and the Water Quality Control Division (WQCD) of the Colorado Department of Health.

The Colorado Water and Sewer Needs Committee has established a rating system to evaluate priority of needs for sewage treatment facilities similar to that used for drinking water systems. The rating scale and criteria are shown below.

| | |
|---|---|
| A Category: | Immediate Needs, Construction Required Within 3-5 Years. |
| A-1 | Demonstrated health hazard |
| A-2 | National Pollutant Discharge Elimination System (NPDES) permit violation from inadequate capacity design or mechanical failure |
| A-3 | Flow and population projections show inadequate capacity within a five-year period |

[1] BRP, Vol. II, p. 168 (1980 capacity).

| | |
|---|---|
| **B Category:** | Longer-Term/Emerging Needs, Construction Required Within 5-10 Years |
| B-1 | Potential health hazard from contamination of surface or groundwater, or from surfacing effluent |
| B-2 | NPDES permit is out of compliance for reasons other than capacity, or for reasons which are unknown |
| B-3 | Flow and population projection show inadequate capacity within a ten-year period |
| **C Category:** | No Demonstrated Problems and No Suspected Population or Inflow Impacts Foreseen |

Source: CIP, p. 108.

**Investment Needs**

Every two years the U.S. Environmental Protection Agency (EPA) surveys all sewage treatment systems in the State and projects improvements needed to meet Federal standards.[1] The EPA estimated that by the year 2000 these systems should have a treatment capacity of 538 million gallons per day (mgd), including 82 mgd for industrial users. The EPA's estimates were based on a projected population of 4,371,000. The Panel's estimates are those of the EPA adjusted for the higher population projection (4,688,740) assumed by the Panel.* Investment needs were estimated by the Panel at $390 million for the period 1983-1987 and $923 million for the period 1988-2000.[2]

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[1]This paragraph is based on BRP, Vol. II, p. 168.

[2]BRP, Vol. II, p. 171.

*The State Demographer's "medium" population projection for 2000 is $4,512,700. The Panel's projection of treatment capacity needs will be higher than warranted by the most recent official estimate of population in 2000.

The Colorado Water and Sewer Needs Committee identified 94 communities that have a category "A" need under the criteria described earlier.[1] Of these 94 communities, the OSPB, included in its CIP those municipalities of 5,000 or fewer in population with an A category need and those with systems rated as category "B" needs that will become category "A" needs within 5 years. The investment needs for these 57 municipalities so identified was estimated at $167 million for the period 1982-1987 and $53.1 million for an unspecified period beyond 1987.

For municipalities over 5,000 in population, the OSPB estimated that $138 million will be needed between 1982 and 1987 to address sewage treatment needs. Communities with populations over 5,000 have traditionally relied on Federal rather than State funds for sewage treatment systems. The needs projected by the Panel and OSPB are summarized on Table 34 in approximately equivalent 1982 dollars.

Table 34

Comparison of Investment Needs for
Sewage Treatment Systems
(Millions of 1982 Dollars)

| | 1983-1987 | 1988-2000 | Total |
|---|---|---|---|
| BRP* | 390 | 923 | 1,313 |
| OSPB** | 305 | 53.1*** | 358 |
| 5,000 population | 167 | | |
| 5,000 population | 138 | | |

*Based on a per-capita expenditure projection.

**Based on a facility-by-facility evaluation.

***Needs for an unspecified period "beyond 1987".

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[1]The next two paragraphs are based on CIP, pp. 108-110, 125-136.

The Blue Ribbon Panel and OSPB estimates indicate that between $300 and $400 million for the 1983-1987 period will be needed for capital investment in sewage treatment sytems. The OSPB did not make estimates of investment needs beyond 1987, and the investment needs for the 1988 to 2000 period estimated by the Blue Ribbon Panel will be used in the case study. For the 1983-1987 period, the OSPB estimate will be used because it was based on an inventory of facilities rather than on a projection of historic per capita expenditures.

The response of local governments to the CSLGF survey, when extrapolated to represent the survey population, showed that counties and municipalities spent an average of about $73 million per year between 1980 and 1982 on capital investment for sewage treatment and collection. (Table 35)

Table 35

Capital Expenditures for Sewage Treatment and Collection 1980-1982 (Millions of Dollars)

| | 1980 | 1981 | 1982 |
|---|---|---|---|
| Counties | 0.95<br>(1.46)* | 0.41<br>(0.63) | 1.98<br>(3.05) |
| Municipalities | 30.2<br>(52.1) | 27.2<br>(46.9) | 65.7<br>(113) |
| TOTAL | 31.2<br>(53.6) | 27.6<br>(47.5) | 67.6<br>(116) |

*Survey response extrapolated over entire survey population.
Survey response: counties 65%, municipalities, 58%.

Source: CSLGF, Vol. II, pp. D-5, D-6.

If this average expenditure is projected over the periods 1983-1987 and 1988-2000, investment need estimates of about $365 million and $949 million, respectively, can be made. These projections are close to those made by the OSPB and the Blue Ribbon Panel for the 1983-1987 period and that of the Panel for the 1988-2000 period.

**Revenues**

Revenue sources for municipal sewage treatment systems have varied primarily according to population.[1] Municipalities under 5,000 in population are eligible for grants (usually 60% of cost)[2] from the State's Sewer Construction Fund which has provided about $2 million per year. Selected projects in northwest Colorado have also been financed through the Oil Shale Trust Fund. Small amounts of money have been available through the Farmers Home Administration.

The primary source of funds for municipalities over 5,000 in population have been EPA grants awarded on a 75-25 Federal-local matching basis. For Colorado, these grants have averaged about $30 million per year from 1971 to 1981.[3] Local revenues are derived from users fees, taxes, and bonds. Table 36 shows revenues for capital investments in sewage treatment systems for the period 1977-81.

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[1]The following two paragraphs are based on CIP, pp. 108-109.

[2]State grants provide for a maximum of 80% of cost and are based in part on a determination of financial need made by the Department of Local Affairs -- interview with Water Quality Control Division staff, July 1982.

[3]BRP, Vol. III, p. 107.

Table 36

Capital Investment Revenues
1977-1981
(Millions of Dollars)

| | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|
| Federal | 8.8 | 43.1 | 42.6 | 33.2 | 28.7* |
| State | 0.5 | 2.9 | 1.9 | 5.9 | 4.1 |
| Local | 2.9 | 14.6 | 14.5 | 11.6 | 11.2 |
| TOTAL | 12.2 | 60.6 | 59.0 | 50.7 | 44.0 |

Source: BRP, Vol. III, p. 107.

*Source: CIP, p. 109.

After much delay and uncertainty, EPA construction grants for FY 1982 were recently released. Colorado's 1982 share of the $2.4 billion that Congress has authorized through 1987 was $21.7 million. The WQCD anticipates that $1.0 million will be distributed to local governments and special districts from the Sewer Construction Fund during FY 1982.[1]

The Blue Ribbon Panel projected that Federal sources, primarily EPA construction grants, would provide an average of only $1.1 million per year from 1982-1987.* This projection is too low as Colorado received $21.7 million in 1982 or almost as much in one year as the Panel anticipated for the entire 21 year period between 1981 and 2001. Congress has authorized $2.4 billion annually for construction grants

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[1]Interview with WQCD staff, July 1982.

through 1987, and it is probably safe to assume that Colorado will receive approximately $20 million each year through 1987. Beginning in FY 1985, however, the Federal share of construction costs will be reduced from 75 percent to 55 percent,[1] and at least $16 million in matching funds will be required to receive the full $20 million allocation.

For the period 1982-1987, the Panel's projections should be amended to reflect more recent information. The Panel's revenue projections for local sources, a constant $25 million per year, are probably too high. Table 37 shows an estimate of investment revenues based on more recent information obtained during the preparation of the case study. The estimate of local revenues was based on the matching requirement to obtain Federal funds that are likely to be available. The estimate of State revenues was based on the continuation of the 1982 funding level from the Sewer Construction Fund.

Table 37

Projected Investment Revenues 1983-1987
(Millions of 1982 Dollars)

| | 1983 | 1984 | 1985 | 1986 | 1987 | Total |
|---|---|---|---|---|---|---|
| Federal | 20 | 20 | 20 | 20 | 20 | 100.7 |
| State | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 5.0 |
| Local* | 8.4 | 8.4 | 8.4 | 17 | 17 | 67.8 |
| TOTAL | 29.4 | 29.4 | 38 | 38 | 38 | 173 |

* Local share based on need to provide 25% of Federal grants and 40% of State grants in 1983 and 1984, and 45% of Federal grant and 40% of State grants from 1985-1987.

[1] Interview with WQCD staff, July 1982.

Needs versus Revenues

The OSPB and Blue Ribbon Panel estimates of need fall in the range of $300-$400 million for the 1982-1987 period. Projected revenues run about $173 million (Table 37), and a shortfall of $127 to $227 million can be anticipated between 1982 and 1987. The OSPB proposed in its CIP to provide $25.3 million to assist municipalities with populations under 5,000. If the proposed investment program is adopted by the Legislature, the shortfall will be reduced to about $100 to $200 million.

Projections of needs beyond 1987 are difficult to make and are prone to error. Such projections do not account for wear, design flaws, operation and maintenance procedures, and changes in discharge standards. All of these variables make 20-year projections very difficult and, in the view of the WQCD, quite unreliable.[1] Nevertheless, the estimate made by the Blue Ribbon Panel, $923 million (Table 34), will be used in this case study to provide a rough indication of investment need between 1988 and 2000.

Revenue estimates are even more uncertain. The Blue Ribbon Panel projected $484 million in revenues from Federal, State, and local sources for the period 1988-2000. The Panel's projection was the only one available and will be used in the case study. Capital investment needs and revenues are summarized in Table 38. A capital investment shortfall of $571 million is projected for the 1983-2000 period.

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[1]Interview with WQCD staff, July 1982.

Table 38

Investment Needs and Revenues for
Sewage Collection and Treatment
1983-2000
(Millions of 1982 Dollars)

| Needs | | | Revenues | | | Needs Minus Revenues | | |
|---|---|---|---|---|---|---|---|---|
| 1983-1987 | 1988-2000 | Total | 1983-1987 | 1988-2000 | Total | 1983-1987 | 1988-2000 | Total |
| 305(a) | 923(b) | 1,228 | 173(c) | 484(b) | 657 | 132 | 439 | 571 |

Source: (a) CIP.

(b) BRP.

(c) Case study text

VI

# SOLID AND HAZARDOUS WASTE MANAGEMENT

## Background

About 1.9 million tons of municipal solid wastes are deposited each year in Colorado's 201 landfill sites. Liquid wastes and sludges are also generated by municipal sewage treatment plants, industry, and by air pollution control equipment. The location, design, and operation of solid waste landfill sites are regulated by the Colorado Department of Health and local governments.

Hazardous wastes require careful management from source to disposal site. Under the Federal Resource Conservation and Recovery Act, all hazardous wastes must be tracked, and all hazardous waste sites and facilities must be located, designed, and operated in accordance with Federal criteria and permit requirements. About 648,000 tons of hazardous and 86,000 tons of extremely hazardous wastes are generated in Colorado each year. The Lowry facility, the only commercial hazardous waste disposal site in Colorado, was closed in July 1982.

## Investment Needs

The Blue Ribbon Panel projected that solid and hazardous wastes would increase in direct proportion to population growth, although the rate of increase would also depend on the level of industrial processing and mining

activities. Capital investments will be needed in the next 20 years to construct and operate additional municipal industrial waste disposal facilities and to construct two hazardous waste sites. The Panel estimated that the hazardous waste sites will cost about $10 million each (1980 dollars).

Investment needs for solid waste collection and disposal were estimated by using an average per capita cost of $57 per year derived from EPA records. Sanitary land fill was assumed to be the method of disposal. The Panel also assumed that capital costs for disposal of wastes from oil shale mining and processing and from other mining activities would be paid for by industry and did not include them in their estimates. A total public and private investment need of about $1.8 billion for solid and hazardous waste management between 1983 and 2000 was projected. To estimate the public investment need, the Panel assumed that investment needs for hazardous waste disposal needs and about 55 percent of solid waste disposal will be privately financed. The Panel estimated that approximately that $608 million in public investment will be needed for solid waste disposal between 1983 and 2000.

**Revenues**

Table 39 shows historical revenues for capital investment based on data that the Panel obtained from the Department of Local Affairs. The Blue Ribbon Panel estimated future revenues by taking the ratio of average capital outlays

Table 39

Solid and Hazardous Waste Management
Historical Trends of Revenues
for Capital Investment
($ Millions)

| | | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Federal Sources (none) | | | | | | | | | | | | |
| State Sources (none) | | | | | | | | | | | | |
| Local Sources | | | | | | | | | | | | |
| Counties | | | | | | | | | | | | |
| Sanitation: | Expenditures | .9 | 1.2 | 2.0 | 2.4 | 2.5 | 2.7 | 2.7* | 3.5* | - | | |
| | Capital Outlay (Total) | .4 | .8 | .1 | .1 | .2 | .1 | - | - | - | | |
| Municipalities | | | | | | | | | | | | |
| Sanitation: | Expenditures | 3.1 | 3.3 | 3.7 | 3.8 | 4.2 | 4.8 | 5.8* | 6.0* | - | | |
| | Capital Outlay (Total) | .1 | .1 | .2 | .2 | .4 | .3 | - | - | - | | |
| City of Denver (a) | | | | | | | | | | | | |
| Sanitation: | Expenditures | 6.5 | 7.4 | 8.2 | 8.7 | 10.2 | 11.4 | 12.4* | 13.2* | | | |
| | Capital Outlay | --- | --- | .4 | .4 | .4 | .3 | .7 | .1 | .5 | | |

SPECIAL NOTE:

Collection: Estimate that private collection constitutes 65% and public collection 45% of the system.

Landfill Operations: Estimate that private operation constitutes 70% and public operation 30% of the system.

(a) Capital outlay data were obtained from the Department of Public Works and primarily involves trash trucks. It is assumed that capital outlays for santitation primarily involve this expenditure as part of collection. Local government collections pay tipping fees at privately operated disposal sites.

Source: BRP, Vol. III, p. 116.

*Source: Interview with Division of Local Government staff, July 1982.

to average personal income for the years 1975 and 1978 and projecting this ratio as a constant over the period 1981-2001. Revenue estimates of $12 million for the period 1983-1987 and $80 million for the period 1988-2000 were derived from the Panel's projections. Revenues projected for the period 1983-2000 totaled at $92 million.

## Needs versus Revenues

To compare needs and revenues, the Panel assumed that the publicly provided portions of collection and land fill operation were 45 percent and 30 percent, respectively. From the estimate of needs and revenues made by the Panel, investment needs will exceed revenues by about $516 million during the period 1983-2000. **Table 40** summarizes capital investment needs and revenues for solid and hazardous waste disposal.

**Table 40**

**Summary of Capital Investment Needs and Revenues for Solid and Hazardous Waste Disposal (Millions of 1982 Dollars)**

| Needs | | | Revenues | | | Needs Minus Revenues | | |
|---|---|---|---|---|---|---|---|---|
| 1983-1987 | 1988-2000 | Total | 1983-1987 | 1988-2000 | Total | 1983-1987 | 1988-2000 | Total |
| 78 | 530 | 608 | 12 | 80 | 92 | 66 | 450 | 516 |

# VII

# CONCLUSION

## Summary

This case study of Colorado's public infrastructure investment needs for transportation, water, sewage treatment, and solid waste disposal was begun in July 1982 to update the Blue Ribbon Panel reports that were published in July 1981 but which relied on some data that were *circa* 1978 in vintage. During eighteen months of intensive work, the Panel gathered and analyzed a great quantity of data. As with most intensive, *ad hoc* efforts of this kind, however, the overiding purpose to derive monetary estimates of need meant that the Panel staff could only mention the many important economic, social, and political issues that entwine any analysis of infrastructure needs.

It was soon discovered in preparing this case study that each agency that made estimates of investment needs or provided data for the Panel staff did so based on its own perceptions of what constituted need. Furthermore, estimates of needs prepared for an *ad hoc*, high-visibility project were often made outside of the agencies' established planning and budgeting processes. In other words, "need" was not defined prior to the gathering and analyses of data and turned out to be highly specific to the type of infrastructure under consideration. There was also no assurance that estimates of need would ever be translated into provision of facilities and services by the appropriate agencies if additional revenues became available.

To project a state's aggregate infrastructure needs is to add little to an understanding of how a state is to raise and allocate limited revenues among competing investment alternatives. Infrastructure has a history as well as a future, and one must understand the institutional context out of which the existing infrastructure was funded and built if one is to anticipate how it is to be maintained and augmented in the future. The body of the case study was devoted to an exposition of this institutional context for the four components of infrastructure under consideration. For the purpose of summary, Table 41 shows the estimates of investment needs, revenues, and shortfall derived from the case study.

Table 41

Infrastructure Needs, Revenues, and Gaps
1983-2000
(Billions of 1982 Dollars)

| | Needs | Revenues | Need Minus Revenues |
|---|---|---|---|
| **Transportation** | **12.2** | **3.97** | **8.23** |
| Highways, Bridges and Grade Separations | 7.73 | 1.92 | 5.81 |
| Railroads | 0.23 | 0 | 0.23 |
| Public Surface Transportation | 2.25 | 0.54 | 1.70 |
| Airports | 1.97 | 1.51 | 0.46 |
| **Water Systems** | **2.02** | **2.02** | **0** |
| Agricultural | 1.25 | 0.96 | 0.29 |
| Municipal | 0.77 | 1.06 | (0.29) |
| **Sewage Treatment** | **1.23** | **0.66** | **0.57** |
| **Solid and Hazardous Wastes** | **0.61** | **0.09** | **0.52** |
| **TOTAL** | **16.1** | **6.74** | **9.36** |

(Totals may not add exactly due to rounding)

A rough estimate of the difference between investment needs and revenues for these four components of Colorado's public infrastructure is $9.36 billion in 1982 dollars for the period 1983-2000. There are many uncertainties attached to this figure, and it should be used only with a full understanding of the discussion presented in the body of the case study.

○